January
1978

# Field Museum of Natural History Bulletin

SHOUT
SHARE
IT

# Field Museum of Natural History Bulletin

January 1978
Vol. 49, No. 1

*Editor/Designer:* David M. Walsten
*Production:* Oscar Anderson
*Calendar:* Nika Semkoff Levi-Setti
*Staff photographer:* Ron Testa



## Field Museum of Natural History
Founded 1893

*President and Director:* E. Leland Webber

BOARD OF TRUSTEES

Blaine J. Yarrington, *chairman*
Mrs. T. Stanton Armour
George R. Baker
Robert O. Bass
Gordon Bent
Harry O. Bercher
Bowen Blair
Stanton R. Cook
O. C. Davis
William R. Dickinson, Jr.
Thomas E. Donnelley II
Marshall Field
Nicholas Galitzine
Paul W. Goodrich
Hugo J. Melvoin
William H. Mitchell
Charles F. Murphy, Jr.
James J. O'Connor
James H. Ransom
Mrs. Joseph E. Rich
John S. Runnells
William L. Searle
Edward Byron Smith
Robert H. Strotz
John W. Sullivan
William G. Swartchild, Jr.
Edward R. Telling
Mrs. Theodore D. Tieken
E. Leland Webber
Julian B. Wilkins

LIFE TRUSTEES

William McCormick Blair
Joseph N. Field
Clifford C. Gregg
Samuel Insull, Jr.
William V. Kahler
Remick McDowell
J. Roscoe Miller
James L. Palmer
John T. Pirie, Jr.
Donald Richards
John G. Searle
John M. Simpson
J. Howard Wood



*Field Museum of Natural History Bulletin* is published monthly, except combined July/August issue, by Field Museum of Natural History, Roosevelt Road at Lake Shore Drive, Chicago, Il. 60605. Subscriptions: $6 a year; $3 a year for schools. Museum membership includes *Bulletin* subscription. Opinions expressed by authors are their own and do not necessarily reflect the policy of Field Museum. Unsolicited manuscripts are welcome. Postmaster: Please send form 3579 to Field Museum of Natural History, Roosevelt Road at Lake Shore Drive, Chicago, Il. 60605. ISSN: 0015-0703. Second class postage paid at Chicago, Il.


## CONTENTS


3 **The Gamelan**
*by Sue Carter-De Vale*

10a **Field Briefs**

10c **Index to Field Museum of Natural History Bulletin, Volume 48 (1977)**

13 **Restoration of the Gamelan**
*by Louis Pomerantz*

19 **January and February at Field Museum**
Calendar of Coming Events


## COVER

Detail from gongstand of Field Museum's gamelan, a 24-piece Javanese musical ensemble. Shows center of gongstand (full view shown on p. 9), representing elements in Javanese cosmology. The central motif consists of the lotus, showing foliage (green), flowers (two gold medallions), and a golden root with blue offshoots. Flanking the lotus are two blue *makara*, or sea monsters (only heads visible here).

Drawing above shows an entire *makara*, as it is represented in the gongstand. Drawing below shows *kala*-head, as it is concealed in the gongstand's lotus. In Javanese mythology, the lotus is the source of life in the upper world. The *makara* are the guides to the upper world; the *kala*-head is the spiritual sun. The *kala-makara* combination symbolizes the soul's gate to the upper world. The gamelan's largest hanging gong, the *gong ageng*, is regarded as the wellspring of music; appropriately, in the 1893 gamelan, the *gong ageng* hangs below the lotus, source of life. For further discussion of Javanese cosmology and how Field Museum's gamelan relates to it, see "The Gamelan," by Sue Carter-De Vale, p. 3.

Under grants from the National Endowment for the Arts and the Walter E. Heller Foundation, Field Museum's gamelan has been restored and is being used for instruction and public performances at Field Museum by advanced students and interested adults. The gamelan instruments are now on permanent display, with audio supplements, in Hall K, ground floor.

Photo by Ron Testa. Drawings by Donn Allen Carter.

*Center portion of* bonang barung *(gong chimes), consisting of a set of 14 pot gongs. Length 198 cm.*

# The Gamelan

**By Sue Carter-De Vale**

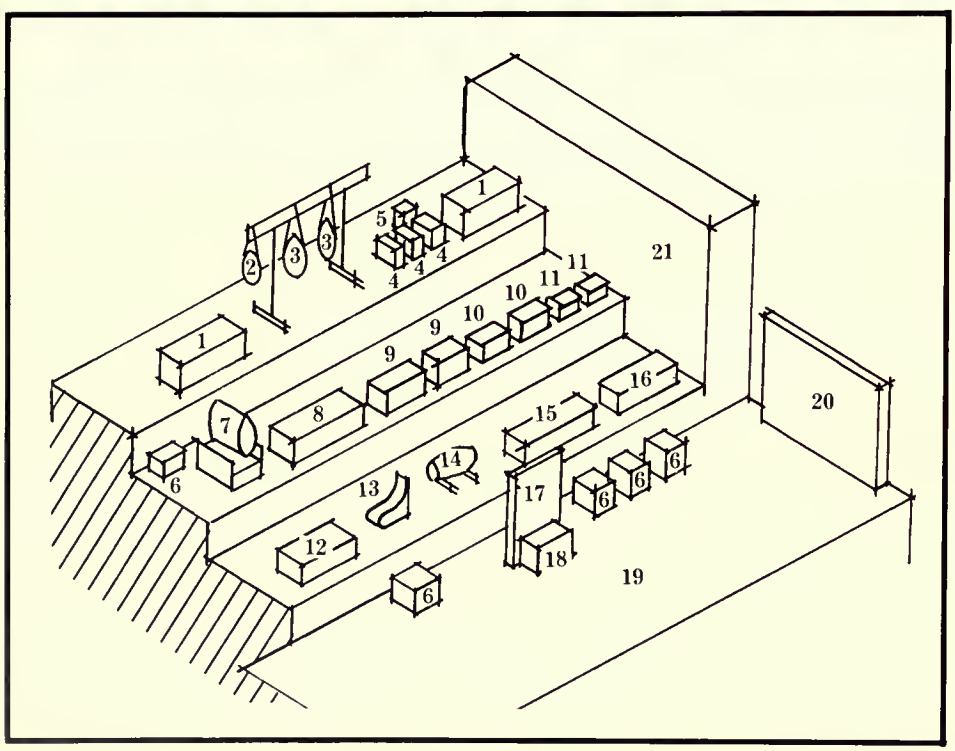
*Color photography by Ron Testa*
*Drawings by Donn Allen Carter*

Field Museum's 24-piece gamelan, acquired in 1893, represents one of the most important classical music traditions in Southeast Asia. Gamelan is the Indonesian term for various orchestral ensembles on the islands of Java, Madura, Bali, and in mainly Javanese settlements in other parts of Indonesia, Malaysia, and even in Surinam (former Dutch Guiana, in northern South America). In western cultures, musicians own their own instruments and combine them in ensembles such as symphony orchestras and bands; the gamelan,

---

*Sue Carter-De Vale, a professional harpist and musicologist, is gamelan program and research director. Additional information on the gamelan may be found in her doctoral dissertation,* A Sundanese Gamelan: A Gestalt Approach to Organology, *Northwestern University, 1977.*

The gamelan instruments shown in this 1893 photo are now on view, with audio supplements, in Hall K, ground floor.




**Above:** 1893 photo of Java Village theater interior, showing Field Museum gamelan on stage. Drawing at left shows probable position of instruments and stage pieces.

1. JENGGLONG
2. KEMPUL
3. GONG AGENG
4. KENONG
5. KETUK
6. BENCH
7. BEDUG and STAND
8. GAMBANG KAYU
9. SARON DEMUNG
10. SARON BARUNG
11. SARON PEKING
12. BONANG PANERUS
13. REBAB and STAND
14. KENDANG and STAND
15. BONANG BARUNG
16. GAMBANG GANGSA
17. SCREEN
18. DRAPED BENCH
19. STAGE WHERE DANCERS PERFORMED
20. RACK for PUPPETS
21. ENTRANCE for MUSICIANS and DANCERS

however, is a permanent ensemble and the musicians come together to play on it.

Gamelans are basically percussion ensembles, but sometimes include a two-string fiddle, zither, flute and human voices. The bronze instruments include gongs, suspended horizontally or vertically, and metallophones (bronze "xylophones"). The sounding parts of the percussion instruments—except for the drums and the one wooden-key xylophone—are usually bronze, but sometimes are made of iron, wood, or bamboo.

The wooden stands and resonators may be simple unpainted frames or ornate polychrome (multicolored) sculptures. Painted gamelan are usually one or two shades of the same color, with carving or detail highlighted with gold leaf or paint. Most ornamentations are paintings or stylized carvings of plants and animals. Zoomorphism, in which the instruments are in the shapes of animals, is rare; anthropomorphism is exceptional.

When the gamelan ensemble as we know it today originated is a matter of controversy. Legend attributes the invention of the gong—long before man came to Java—to the god Batara Guru, who created a small gong to summon the lesser gods. Soon, there were so many signals necessary that he made two more gongs, both of different pitch. These three provided the basis for a sacred form of gamelan still known as *munggang*. The rest of the instruments were in existence by the end of the Hindu-Javanese period, some five centuries ago, but not combined in large mixed ensembles. This development probably occurred after the coming of Islam to Java in the sixteenth century. The large gamelan ensembles we know today developed between the eighteenth and twentieth centuries.

In Javanese thought, a gamelan is one of the many manifestations of *kasekten*, supernatural charismatic power. The *kasekten* of certain gamelan is believed to be so strong that it can influence nature: it may cause rain to fall or arouse turbulent human emotions. This power is invested in the music of the gamelan—in its very sound. Because of this "power," musicians and nonmusicians alike are deeply respectful of the gamelan—a respect shown by offerings of incense and flowers and other actions. No one sits higher than the big gongs, the gamelan is played shoeless, and no one steps over an instrument; it is moved gently aside if there is not room to pass.

The gamelan is played by both professional and amateur groups in Java. It is used for concert music at social, cultural, and ritual gatherings, and as an intrinsic element of most theater and dance forms. Gamelan is played to welcome guests and audience and to announce the entrance of royalty. It is also important in music education. Indonesian radio stations broadcast gamelan music daily.

The total range of gamelan instruments often spans six octaves (approximately the same range as a western orchestra less its highest octave). Two Javanese tonal systems supply modal structures: *pelog*, with seven intervals of unequal size per octave; and *slendro*, with five nearly equal intervals. Neither system has a fixed scale in the western sense, because no two gamelan are tuned alike, nor is the concept of absolute pitch known in Java. Field Museum's 1893 gamelan has a *pelog* tuning.

The basis of each gamelan composition (*gending*) is a traditional "nuclear" melody of a given length and structure. A *gending* may be described as the presentation of a single melody in "layers." Specific instruments are assigned to each of five functions: in each composition a nuclear melody is simultaneously played in its purest form, paraphrased, enhanced by a related countermelody, punctuated, and provided with a rhythmic continuum which also signals tempo and volume.

One of the most musically important aspects of gamelan performance is the fact that gamelan musicians perform together in a communal musical unity, not as individual musicians playing separate instruments. Because their musical roles are equally important and interdependent, there is no room for stardom. Though a gamelan musician may specialize in certain instruments, he is accomplished on most or all of the others.

In the last 25 years, the gamelan has become a favorite nonwestern ensemble for westerners to learn,

*Pak Suminta Mein, leader of the 1893 gamelan, playing the* rebab *(fiddle) during the exposition.*

and at least 14 American colleges and universities have, at considerable expense, purchased gamelan. Field Museum's 1893 gamelan is the only such ensemble within 150 miles of Chicago. Additional instruments to augment the 1893 gamelan have been purchased and the ensemble has been restored for the teaching and performance of its classical music. This was made possible by a grant from the Walter E. Heller Foundation and the special interest of Mrs. Edwin J. DeCosta, and by a grant from the National Endowment for the Arts. Bennet Bronson, associate curator of Asian archaeology and ethnology, is director of the gamelan project, Louis Pomerantz is conservator, and Ernst Heins is external adviser.

The history and symbolism of Field Museum's 1893 gamelan unveiled itself like the plot of a spellbinding mystery. Beginning with the World's Columbian Exposition of 1893 in Chicago, and Dutch plantations in nineteenth-century Java, it wove its threads through Javanese artistic techniques, color symbolism, sociocultural values, cosmic philosophy, and into the structure of gamelan music itself. In a two-year game of international musical intrigue, the research took me from coast to coast, to the Netherlands, and around the world to Java.

While in Washington, D.C., in May 1976, I learned quite by accident that the Library of Congress held 33 wax cylinder recordings of Field Museum's gamelan made during the 1893 exposition. These are the oldest known recordings of any gamelan. The property of Harvard's Peabody Museum, they were made by Benjamin Ives Gilman, the first person to use the phonograph for the scientific analysis of music. Gilman's cylinders and his accompanying notes opened a window to the past, giving us a musical and descriptive record of an entire performance of our gamelan in the "Java Village" at the Columbian Exposition.

That same evening I was to learn that a Miss Norma Boreel, who played in a gamelan group at the Gemeentemuseum in The Hague, the Netherlands, was the granddaughter of Pak Suminta Mein, leader and *rebab* (fiddle) player of the 1893 gamelan in Chicago. Miss Boreel later lent us her grandfather's photo album and commemorative medallions from the exposition.

That summer and fall I searched American libraries and historical archives for information on the exposition, and began trying to decode the symbolism in the gamelan's design. In the Netherlands, in February 1977, I learned that the "Java-Chicago Syndicate," responsible for bringing the 1893 gamelan and an entire Sundanese (West Javanese) village to the Columbian Exposition, represented Dutch plantation owners in West and Central Java. This syndicate, which sold the gamelan and associated dance costumes and masks to the Museum on November 9, 1893, was organized by G. C. F. W. Mundt of

*Drums of the 1893 gamelan as found in storage: one* bedug *(rt.) and two kendangs. The bedug is 63 cm high, the* kendangs *43 and 69 cm high.*

Gambang kayu, *or true xylophone with wooden keys. Length 135 cm.*

Parakan Salak, and E. J. Kerkhoven of Sinagar. These neighboring plantations, west of the city of Sukabumi, were among the largest in Java. The Java-Chicago Syndicate members came to Chicago with the main objective of selling their produce: tea and coffee. The village, the gamelan, and the Javanese themselves were all part of a promotional effort; customers were attracted into the village where they were to sample the Javanese beverages. These same Dutch entrepreneurs had sponsored similar Javanese exhibits at the Amsterdam exposition of 1883 and the Paris exposition of 1889.

The 1893 gamelan represents a type of gamelan, in size and design, that was found at Sundanese courts, as opposed to villages. A particular instrument in the 1893 gamelan, the *gambang gangsa* (18-key, bronze "xylophone"), is a rare and archaic form that belonged only to court orchestras. To own a court-style gamelan, such as the 1893 ensemble, was a status symbol for the Dutch who had acquired great power and wealth in Java. In using the gamelan and dance performances to promote their products at the expositions, the Dutch were utilizing elements of the island culture which had become important in their own lives.

Chicago, in 1893, was perhaps the most exciting city in America. Several years of elaborate preparation culminated in the World's Columbian Exposition, held from May 1 to the end of October. Its organizers envisioned it as the biggest and best in the history of expositions, placing special emphasis on educational features, such as the latest developments in science and industry. Cultural exhibits, such as the Java Village, represented peoples from around the world.

Music was everywhere, with Western music produced by gigantic symphony orchestras, spectacular choruses of 5,000 voices, and military marching bands. Music from other parts of the world was heard along the Midway Plaisance. While Samoans sang and Dahomeans danced, the impresario of the Chinese theater complained that the Scottish piper "in the red skirt with a big bag of wind in his mouth," confused his Chinese orchestra.

The Java Village was a reconstruction of a village from West Java, complete except for the lack of lush tropical vegetation. The village fence enclosed homes for the Dutch colonials from Sinagar and Parakan Salak, and for the Javanese people. On the front porches, women demonstrated the art of batik, weaving techniques, and embroidery. In the center of the village stood a mosque where the faithful were called to prayer by a large *bedug* (drum). Free coffee, tea, and cocoa were dispensed from a teahouse. Strolling through the village, one heard the melodies of the *anklung* orchestra (tuned bamboo rattles) or, for 25 cents, one could enter the theater for various Sundanese and Central Javanese performances.

The 1,000-seat bamboo theater reportedly had more than 82,000 patrons during the exposition's run. The theater fare included chamber concerts with ensembles of *suling* (flute), *kacapi* (zither), and *tarawangsa* (fiddle). In the evenings, the 1893 gamelan accompanied performances of two types of *wayang*, the masterful narrated plays of puppetry and human dance, relating heroic episodes from the Mahabharata or Ramayana epics or the Panji cycle.

The music and people in the Java Village were described as "the most popular" of all on the Midway. According to one report, "They were most interesting, these gentle Javanese, and, in certain ways and habits and view of life, quite unlike any other people in the world, so far as the Fair afforded an illustration. There was . . . a certain individuality which showed itself even in their music, which, with its sweet, deep tones, was in pleasant contrast to the shrill clamour of the Plaisance all about."

Information about the age and origin of the 1893 gamelan was gathered from oral and written sources which I found in the U.S., the Netherlands, and finally in Java, in October, 1977. The first important clue to the gamelan's age again came from Gilman, who devoted six of his 1893 cylinders to the sound of the individual instruments. These recordings prove that the gamelan's tuning has remained stable since the exposition and, therefore, that the gamelan was old before it was brought to Chicago. Analysis of the paints and pigments used on the 1893 gamelan's stands and resonators indicate that these instruments could have been made as early as 1840. Where and for whom it was made remains a mystery. Its designer, however, was an artist who knew as much about Chinese art and music in Java as about Javanese symbolism. He was, at least, familiar with certain Chinese stylistic traits, including the use of ultramarine blue; tiny decorative "mirrors"; and the wooden xylophone (*gambang kayu*), which does not have the typical Javanese boxlike shape, but is waisted in the manner of xylophones used in Chinese ensembles in Java. These and other clues narrow the probable provenience of Field Museum's gamelan to one of three cities: Sukabumi or Cirebon, in West Java; or Semarang, in Central Java.

As an ensemble of polychrome sculptures, the 1893 gamelan is an exciting work of art. Its dark blue is accented with light blue, scarlet, shades of green, and highlighted with pure gold leaf. Carvings of flowers, leaves, branches, and roots create a "garden" throughout the gamelan. Animal sculptures include birds, serpents, and tiger-lions with heads at front and rear.

The combination of these design elements is unique to this gamelan, and raised a series of interesting questions: Why is the gamelan a garden of flowers, leaves, and branches? Why do some flowers and foliage seem to be disguised faces? Why are there 16 birds on the four *bonang* instruments (gong chimes)? Why are the six *sarons* (7-key bronze metallophones) in the shape of tiger-lions? Why are only four of the six tiger-lions fashioned to hold their own playing hammers in their mouths? Why does each tiger-lion have a head at each end, rather than a head and a tail? Why can some of the intertwined pairs of *naga* (serpents) on the flanks of the tiger-lions see their tails, while others cannot?

The answers to these questions reveal that the 1893 gamelan is a total symbolic representation of the Javanese cosmos. It is the only known gamelan in which this is true. Of particular interest is that fact that the artist applied those designs to the instruments selectively, revealing for us the cosmic structure which is also present in gamelan music.

Senosastroamidjojo, a contemporary Javanese writer, interprets the cosmos in a way that explains the design of the 1893 gamelan. According to his conception of the Javanese cosmic trinity, the *Triloka*, man develops his life between two regions: an underworld, to which everything belongs that is related to his body and the material outer world; and a god's, or upper, world, to which he strives with mind and soul. Mind and soul are man's link between underworld and upper world. He who wishes to penetrate into the upper world must first be prepared; the earthly mind could not otherwise bear the blinding light of the supernatural spirit. The soul's gate to the upper world is guarded by demons in the service of the gods who block the way for the spiritually unprepared. Sea monsters (*makara*), with fangs and flaming breath crouch beside the soul's gate. It is they who bring the initiate through the darkness of death. When the initiate awakens, he sees the spiritual side of the total cosmos, the basis of all being, the source of life in the shape of a tree. This tree of life stands on the mountain of the gods, the mythological Mt. Meru. The tree symbolically encompasses all three worlds with their gods. The underworld is represented by the tree's root and the *naga*, or serpent; the middleworld by the tree's leaves and the head of a *kala*—the spiritual sun—that illuminates the heart of the cosmos; and the upperworld by the tree's blossoms and Garuda, the eagle-god, or his fellow birds.

The gongstand represents the lotus, the tree of life, the soul's gate to the upperworld, the guides through it (*makara*), and the spiritual sun (*kala*). In the gongstand's center is an image of a lotus in flower, with the shoots of its golden root growing downward, its leaves and flowers upward. These *tunjung*-lotus blossoms, which the artist emphasized with gilding, were traditionally placed on certain gamelans—as well as on palaces—in a prominent position for one to meditate on. They signified the power of the gamelan and that of the person who commissioned its making. From the tip of the lotus, the two main branches of the tree extend across the top of the gongstand, with all their branches and subbranches directed downward. The vegetation on all the gamelan's instruments are extensions of this tree of life.

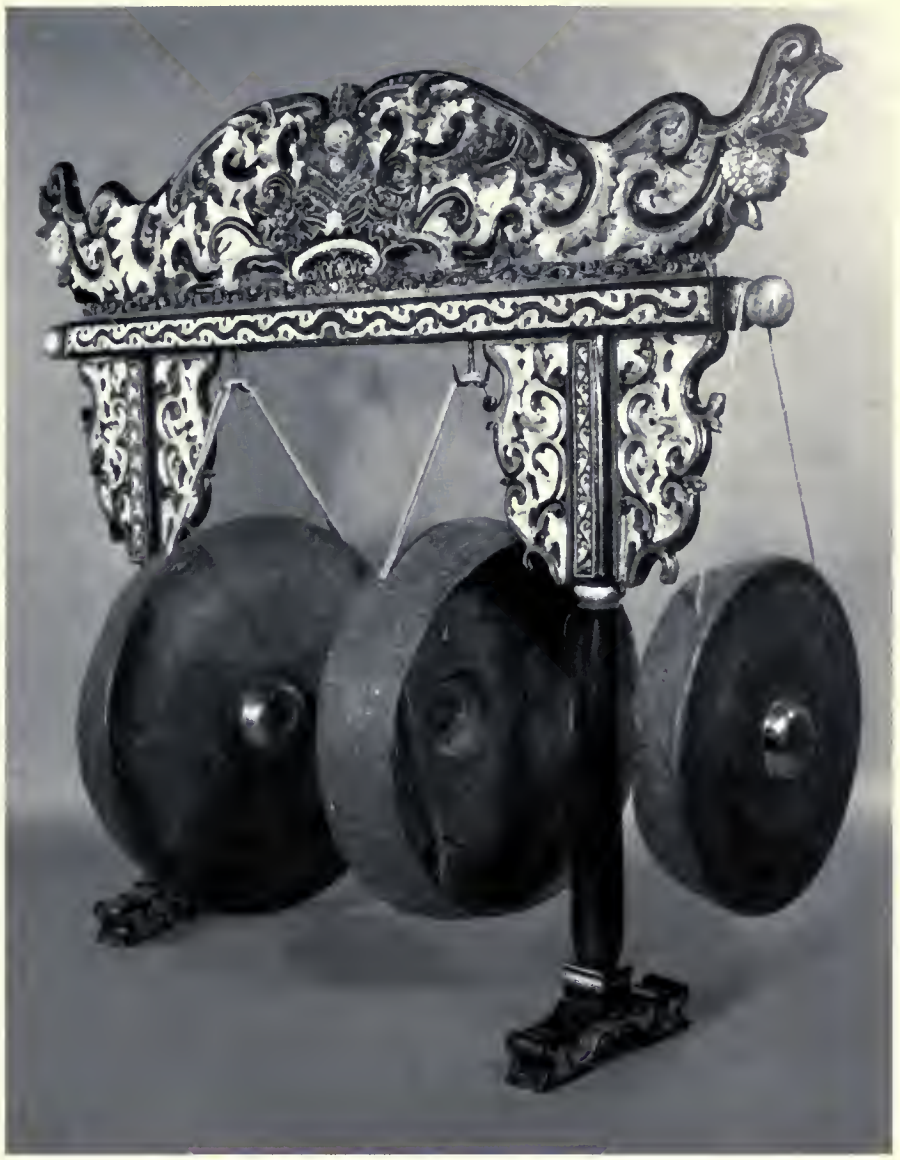
The *kala-makara* combination (symbols of the gate) on the gongstand demonstrates the propensity of Javanese artists for concealing animals in vegetation. As we look closely at the central motif on the gongstand, the hidden *kala* emerges from lotus flowers and root in his traditional form with an open mouth, bulbous nose, moustache, and ornate headdress or coiffure. *Makara* sea monsters, with curled-up, flaming mouths, and elaborate tails, are hiding in the foliage on either side of the *kala*.

The carving on the four sets of gong-chimes in the *bonang* family depicts sixteen birds sitting on four branches of the tree of life. On each of the four corners of the four instruments rests the sculptured head of a peacock or rooster, representing the gods of the upper world.

The six blue tiger-lion *saron* (single-octave bronze metallophones) show the designer's flair for symbols. The dark blue indicates the tiger-lions' guardianship of the upper world and their role of fostering grace. The terrible

power of their teeth and claws is emphasized by giving them a silvery effect, achieved by underpainting the gold leaf with light blue. Elsewhere on the gamelan, the gold leaf is yellowish, achieved by using red as the undercoat. These tiger-lions also represent the middle world of man; the pairs of green *naga* (serpents with headdresses) inter twined along their flanks represent the underworld.

*Tiger-lion metallophone gripping a playing hammer in its teeth*



*Gongstand, with two* gong ageng *(left and center) and a* kempul. *Diameters: 87, 78, and 58 cm respectively.*

The three pairs of small, medium, and large tiger-lion *saron* instruments (shown on page 11) symbolize, respectively, childhood, maturity, and old age; each pair has a different octave range. The smallest, highest-voiced *peking* have small, even sets of teeth and fangs; the middle *saron barung* have large fully developed teeth and fangs. The two largest, lowest-voiced *saron demung* have lost their lower teeth and fangs; only their upper teeth remain. They are like elders who have lost a degree of physical strength, but are still respected for their wisdom and mental powers.

Of each *saron* pair, one is male, one female. The sexes differ from each other in height, length, and the size of their teeth, mouths, and claws; the male has the larger measurements. These tiger-lions have heads at both ends and thus look simultaneously backward and forward—like humans meditating on their past in order to determine their future. The Javanese believe that only this form of meditation can prepare one for the experience of viewing the supernatural light in the upper world.

The artist rendered the pairs of green *nagas* (serpents) on the flanks of the tiger-lions in order to express the meditative growth of humans during their three life stages. The *nagas* present the belief that such meditation does not begin until adulthood, and that only as an elder does one achieve spiritual wisdom. On the smallest tiger-lions, the interwined *nagas* curl so they cannot see their tails: children do not look back at their past life, only ahead to the future. On the adults and elders, however, the *nagas* peer directly at their tails: they are practicing meditation. Only on the wise elders do we find fully developed wings next to the *nagas*—wings to transport their spiritually prepared souls to the upper world on Mt. Meru.

*(Continued on p. 11)*

*Gambang gangsa, a rare type of bronze "xylophone." Length 119 cm*

Kenong *(left) and* ketuk, *punctuating, or colotomic, instruments; 36 and 29 cm in diameter. The 1893 gamelan contains two additional* kenong.

# FIELD BRIEFS

Ron Testa

Seated *(l. to r.): Lorin Nevling and Robert F. Inger;*
standing: *William Burger, Melvin Traylor, and Rupert Wenzel.*

### Staff Appointments

**Lorin I. Nevling,** curator of botany, has been appointed Field Museum's assistant director, science and education. He succeeds Robert F. Inger, who has resigned the post to devote full time to research. A native of St. Louis, Nevling came to Field Museum in 1973 as chairman of the Department of Botany. His research at the Museum has concerned the flora of Veracruz (Mexico).

Before coming to Chicago, Nevling was a curator of Harvard University's Arnold Arboretum and Gray Herbarium, Cambridge, Mass., where he had served since 1959. He received his B.S. from St. Mary's College (Winona, Minn.) and his M.A. and Ph.D. degrees from Washington University.

**Robert F. Inger** was appointed assistant director, science and education, when the post was created in 1971. It oversees the scientific, exhibition, and education departments, as well as the museum library.

Inger received his B.S. and Ph.D. degrees from the University of Chicago and joined the Museum staff in 1946 as an assistant in the Division of Amphibians and Reptiles. He was made assistant curator of fishes in 1949, and in 1954 became curator of amphibians and reptiles. In 1970 he was appointed chairman of scientific programs. Inger has made numerous collecting trips to Southeast Asia and Indonesia and has published extensively on the fish, amphibians, and reptiles of these areas.

**Melvin A. Traylor,** curator of birds, has been named chairman of the Department of Zoology at Field Museum, succeeding Rupert L. Wenzel, curator of insects, who has been chairman since 1970. A native Chicagoan, Traylor joined Field Museum on a volunteer basis in 1940 as an associate in the Division of Birds; in 1948 he was named a research associate. In 1956, after several years in private business, Traylor joined the Museum staff as assistant curator of birds; in 1959 he became associate curator and in 1973 was named curator. In addition to his curatorial responsibilities, Traylor has served since 1972 as chairman of the Museum's Space Planning Committee, which has played a major role in the building rehabilitation program.

Following graduation from Harvard in 1937, Traylor became actively involved in ornithology with a bird-collecting trip to Yucatan; two years later he made another collecting trip to the

same general region. Subsequent field work was to include expeditions to the Galapagos (1941), Mexico (1948), Egypt (1959), and Rhodesia and Bechuanaland (1961-2).

Traylor has published 77 technical papers, largely on bird systematics, and is editor of volume 8 of *Peters' Check-List of Birds of the World;* for the check list he is revising the family Tyrranidae (tyrant flycatchers).

**Rupert C. Wenzel,** who has resigned the zoology chairmanship to devote more time to research, first came to Field Museum (like Traylor) as a volunteer in 1934. In 1940, two years after receiving his baccalaureate from Central YMCA College, he was made assistant curator of insects; in 1950 he became curator of insects. Subsequently he received his Ph.D. in zoology from the University of Chicago.

Wenzel ranks as a world authority on the classification and biogeography of the Histeridae, a family of beetles important in the control of certain insect pests. He is also noted for his work on bat parasites. In addition to his work at the Museum, Wenzel is a lecturer at the University of Chicago and a research associate at Northwestern University.

**William C. Burger,** associate curator of botany, has succeeded Lorin Nevling as chairman of the Department of Botany. A native of New York City, Burger joined the Field Museum staff in 1965. His main curatorial activity has been research on the flora of Costa Rica. He holds a B.A. from Columbia College, New York; and an M.A. and Ph.D. from Cornell University and Washington University, respectively. Before coming to Field Museum he served for four years on the faculty of Haile Selassie I University, Alemaya, Ethiopia.

**Harvey M. Matthew** has been appointed head of controls division, Department of Exhibition. His responsibilities include the monitoring of department schedules and budgets and the coordination of exhibits. Matthew came to the museum in 1976 under a National Endowment for the Arts grant to coordinate the Native American Program, including the construction of the Pawnee Earth Lodge. He later coordinated the Treasures of Tutankhamun exhibition and is now coordinating the Peru's Golden Treasures exhibit, scheduled for public opening on February 16.

*Haida woman photographed on Queen Charlotte Island near turn of century. Her basket (cat. no. 53109), still incomplete, is in the Field Museum collection. She is using a twining technique. The material is split spruce root.*

**Patricia W. Freeman,** assistant curator of mammals, has been named head, Division of Mammals. She succeeds Ronald Turner, who resigned. Dr. Freeman joined the Museum in September, 1977. She was formerly a scientific assistant at the American Museum of Natural History in New York.

**Robert E. Martin** has been appointed facilities and collection coordinator for the Division of Mammals. Martin came to Field Museum in September, 1976. □

### Theresa Ann Panjan

Theresa Ann Panjan, a Field Museum employee since 1964, died recently after a brief illness. At the time of her death she was assistant book shop manager. She will be remembered by thousands of Field Museum visitors, employees, and members for her unfailing courtesy, cheerful spirit, and helpfulness. Mrs. Panjan was a native Chicagoan and is survived by her husband Eugene W., two sons, and a daughter.

### Northwest Coast Basketry

December 15 was opening date for a remarkable exhibit of various kinds of basketwork, all done by Indians of the Northwest Coast around the turn of the century. The artifacts are all from Field Museum's extensive collection. On view in Hall 27, the exhibit includes not only baskets, but a variety of other utilitarian objects made with the same basic materials and techniques: cradles, hats, drinking cups, cooking utensils, and fish traps. The tools for making them are also exhibited.

The baskets themselves range in size from teacup-size containers for holding trinkets to "bins" the size of a laundry hamper. Their makers included Indians of the Salish, Haida, Hupa, Tlingit, Nootka, Yurok, Karok, Tsimshian, Bella Coola, and Chinook tribes.

The three basic techniques used in fabricating the pieces were plaiting, twining, and coiling; the most common materials included cedar bark, spruce root, willow, alder branches, grass, and ferns. The exhibit features regional differences in style as well as construction techniques characteristic of the various groups.

# Index to *Field Museum of Natural History Bulletin*, Volume 48 (1977)

*Prepared with the assistance of Ken Grabowski*

## Titles


*Animals Are Human, Too (Or Are Men Just Little Calculators?)*, by John Terrell: March 3

*Cannibals, Catalogs and Computers*, by Lenore Sarasan, Marilyn J. Miller, and members of the Department of Anthropology: Sept. 10

*Christmas Afternoon at Field Museum, A:* Nov. 27

*Cloud Forests*, by William Burger: Nov. 11

*Egypt Tours for Members:* Oct. 16

*Elephants and the Art of Taxidermy:* Jan. 9

*Endangered and Threatened Species of the United States and Puerto Rico:* June 10

*Exotic Fliers: Portraits of Neotropical Birds:* July/Aug. 4

*Eyes Have It, The*, by Eugene R. Slatick: Jan. 10

*Gamelan Project, The: A Conservator's Challenge*, by Louis Pomerantz: Nov. 23

*Gorillas in Captivity*, by William E. McCarthy: Sept. 7

*Guests of Summer*, by Floyd Swink: July/Aug. 6

*In Search of Meteorites*, by Paul Sipiera: Sept. 14

*In the Daze of the Good King Tut*, by Florence Johnson: Oct. 14

*Kimberley Snail Hunt—Round One*, by Alan Solem: March 6

*Kimberley Snail Hunt—Rounds Two through Four*, by Alan Solem: Oct. 6

*Letters from Antarctica, 1976-77*, by Edward Olsen: Feb. 14

*Letters from Antarctica, 1976-77*, by Edward Olsen: March 16

*Letters from Antarctica, 1976-77*, by Edward Olsen: May 14

*Life in Ancient Peru*, by Robert A. Feldman: June 12

*Living Jewels of the Tropics*, by David M. Walsten: July/Aug. 7

*Looking for 'Unimproved' Land: The Illinois Natural Areas Inventory*, by Mike Madany: June 18

*Major Operation, A*, by Berthold Laufer: Jan. 19

*Mammal-Collecting in the Australian Outback*, by Laurel E. Keller: Nov. 6

*Monkeys Inside and Out:* Nov. 4

*Native Americans through the Camera Lens of Charles H. Carpenter*, by Allan Koss: Oct. 18

*On Coming and Going in Saamiland*, by Myrdene Anderson: May 6

*Pawnee Earth Lodge, The:* Oct. 24

*Père David's Deer*, by Dale J. Osborn: Oct. 10

*Peru's Golden Treasures*, by Michael Moseley: Dec. 3

*Prehistoric Agriculture in the Upper Midwest*, by Thomas J. Riley and Glen Freimuth: June 4

*Rebirth of the Gamelan*, by Sue Carter De Vale and Louis Pomerantz: Nov. 22

*Return of the Risher*, by Roger A. Powell: Feb. 8

*Silver Anniversary for Bushman:* Sept. 4

*Tigers without Their Stripes*, by David M. Walsten: May 12

*Treasures of the Des Plaines*, by Phillip Hanson: July/Aug. 10

*Tut in Retrospect*, Oct. 15

*Tutankhamun and the Fall of the Eighteenth Dynasty*, by William J. Murnane: April 6

*Valcamonica: World's Richest Treasury of Rock Carvings*, by Lois Bolton Lundy: Feb. 3

*Volunteers Honored:* May 22

*Warp of Cedar, Weft of Spruce: Baskets of the Pacific Northwest*, by Helen Chandra, Maija Sedzielarz, and Ron Weber: Nov. 18

*Waterways of Ancient Peru*, by Michael Moseley: March 10


## Authors


Anderson, Myrdene: *On Coming and Going in Saamiland*, May 6

Burger, William: *Cloud Forest*, Nov. 11

Carter-De Vale, Sue: *Rebirth of the Gamelan* (with Louis Pomerantz), Nov. 22

Chandra, Helen: *Warp of Cedar, Weft of Spruce* (with Maija Sedzielarz and Ron Weber), Nov. 18

Feldman, Robert A.: *Life in Ancient Peru*, June 12

Freimuth, Glen: *Prehistoric Agriculture in the Upper Midwest* (with Thomas J. Riley), June 4

Hanson, Philip: *Treasures of the Des Plaines*, July/Aug. 10

Johnson, Florence: *In the Daze of the Good King Tut*, Oct. 14

Keller, Laurel E.: *Mammal-Collecting in the Australian Outback*, Nov. 6

Koss, Alan: *Native Americans through the Camera Lens of Charles H. Carpenter*, Oct. 18

Laufer, Berthold: *A Major Operation*, Jan. 19

Lundy, Lois Bolton: *Valcamonica: World's Richest Treasury of Rock Carvings*, Feb. 3

McCarthy, William E.: *Gorillas in Captivity*, Sept. 7

Madany, Mike: *Looking for 'Unimproved' Land: The Illinois Natural Areas Inventory*, June 18

Miller, Marilyn J.: *Cannibals, Catalogs and Computers* (with Lenore Sarasan), Sept. 10

Moseley, Michael: *Peru's Golden Treasures*, Dec. 3

_____ : *Waterways of Ancient Peru*, March 10

Murnane, William J.: *Tutankhamun and the Fall of the Eighteenth Dynasty*, April 6

Olsen, Edward: *Letters from Antarctica, 1976-77*, Feb. 14

_____ : *Letters from Antarctica, 1976-77*, March 16

_____ : Letters from Antarctica, 1976-77, May 14

Osborn, Dale J.: *Père David's Deer*, Oct. 10

Pomerantz, Louis: *Rebirth of the Gamelan* (with Sue Carter-De Vale), Nov. 22

_____ : *The Gamelan Project: A Conservator's Challenge*, Nov. 23

Powell, Roger A.: *Return of the Fisher*, Feb. 8

Riley, Thomas J.: *Prehistoric Agriculture in the Upper Midwest* (with Glen Freimuth), June 4

Sarasan, Lenore: *Cannibals, Catalogs and Computers* (with Marilyn J. Miller), Sept. 10

Sedzielarz, Maija: *Warp of Cedar, Weft of Spruce* (with Helen Chandra and Ron Weber), Nov. 18

Sipiera, Paul: *In Search of Meteorites*, Sept. 14
Slatick, Eugene R.: *The Eyes Have It*, Jan. 10
Solem, Alan: *Kimberley Snail Hunt—Round One*, March 6
_____ : *Kimberley Snail Hunt—Rounds Two through Four*, Oct. 6
Swink, Floyd: *Guests of Summer*, July/August 6
Terrell, John: *Animals Are Human, Too (Or Are Men Just Little Calculators?)*, March 3
Walsten, David M.: *Living Jewels of the Tropics*, July/Aug. 7
_____ : *Tigers without Their Stripes*, May 12
Weber, Ron: *Warp of Cedar, Weft of Spruce* (with Helen Chandra and Maija Sedzielarz), Nov. 18

**Subjects**

Abiera, Christine: Nov. 23
Adélie penguin: May 1
adiabatic cooling: Nov. 11
African clawed frog: July/Aug. 18
African violet (gesneriad): Nov. 12
Agricultural Stabilization and Conservation tion Service: June 21
agriculture: June 4
Ahmose I: April 11
AIMS: Sept. 10
Akeley, Carl: Jan. 9; Sept. 8
Akhenaton: April 6
"Albro," shark repellent: Jan. 6
alder, gray (*Alnus incana*): May 19
Alice Springs, Australia: Oct. 9
Allan nunatak: May 15
Allen, Linda: Sept. 12
Allen, Nick: Nov. 6
alligator: June 9
Amarna: April 6
Amax Corp.: Oct. 8; Nov. 10
Amenhotpe I: April 11
Amenhotpe II: April 11
Amenhotpe III: April 6
Amenhotpe IV: April 6
American bittern (*Botaurus lentiginosus*): Jan. 2
American crocodile (*Crocodylus acutus*): Jan. 5
American opposum (*Didelphis marsupialis*): Jan. 14
Amun: April 6
Amun, Temple of: April 6
anaconda (*Eunectes murinus*): Jan. 12
Anati, Emmanuel: Feb. 3
Ancient Irrigation Program: March 10
Anderson, Myrdene: May 6
*Andropogon gerardi*: July/Aug. 11
*Andropogon scoparius:* July/Aug. 11
angelica (*Angelica archangelica*): May 19
*Angelica atropurpurea:* July/Aug. 11
"Animals Are Human, Too (Or Are Men Just Little Calculators?)": March 3
Ankhesenamun: April 7
Ankhesenpaton: April 7
Antarctica: Feb. 14; March 16; May 14
antelope, pronghorn (*Antilocapra americana*): Jan. 14
Anthropology Internship Program: May 3
Anthropology, Department of: Sept. 10
Aransas National Wildlife Refuge: Sept. 23
Armour, Mrs. Stanton T.: Sept. 3
aromatic low calamint: July/Aug. 11
Asiatic elephant (*Elephas maximus*): Jan. 14
Aspero (Peru): June 13
*Astragalus tennesseensis:* July/Aug. 17
Atahualpa: Dec. 3
Atelopodidae: July/Aug. 7
Atlantic giant squid (*Architeuthis sp.*): Jan. 12
Atlantic salmon (*Salmo salar*): May 19
Aton: April 6, 7
Australian wild dog (dingo): Nov 6
Ay: April 11
Ayer Film-Lecture Series: Sept. 3; Oct. 26
Ayers Rock (Australia): Oct. 9

Bacubirito meteorite: Sept. 15
Baer, Klaus: Feb. 13
Baird, Gordon: April 18; May 20
Baker, George R.: March 18
bald eagle: Jan. 8; Sept. 22
bandicoot: Nov. 8
Baraboo Range (Wisconsin): Weekend Geology Field Trip for Members: April 18; 20
Barcelona (Spain) Zoo: Sept. 8
barking tree frog: July/Aug. 7
baskets (Northwest Coast): Nov. 19
Bass, Robert O.: Sept. 3
bat, Indiana (*Myotis sodalis*): Jan. 5
bats (fruit and tree): Nov. 7
Bauer, Charles: Sept. 10
Bedford, Duke of: Oct. 10
Beeman, Gary: Jan. 7
Bella Coola Indians: Nov. 20
Benld meteorite: Sept. 15
Berlet, Walter: Feb. 17
big bluestem grass: July/Aug. 11
birch (*Betula pubescens*): May 19
bird repellent: Jan. 4
bird vision
bird-eating spider *(Theraphosa leblondi):* Jan. 12
*Birds of Mexico: A Guide for Field Identification:* July/Aug. 5
*Birds of Nepal with Reference to Kashmir and Sikhim:* Jan. 10
birdwing butterfly (*Ornithoptera victoriae*): Jan. 12
bittern, American (*Botaurus lentiginosus*): Jan. 2
black oak (*Quercus velutina*): June 22
Blackmon, Carolyn: Nov. 24
Blake, Emmet R.: July/Aug. 2, 5
Blanchard, David: May 23
blue hare (*Lepus timidus*): May 19
blue joint grass: July/Aug. 11
blue, or sulfur-bottomed, whale (*Balaenoptera musculus*): Jan. 13
bobcat: Sept. 22
Bolt, John R.: July/Aug. 14
Boltin, Lee: April 3, 6, 10, 14, 15
Boreel, Norma: Nov. 22
Boulton, Rudyerd: May 5
*Bouteloua cortipendula:* July/Aug. 11
Boxer Rebellion: Oct. p. 12
bromeliad: Nov. p. 13
Bronowski, Jacob: May 8
Bronson, Bennet: Feb 19; Oct. 5; Nov. 22
Brookfield Zoo: Sept. 8
Broome, Western Australia: Nov. 6
Bronx Zoo: Sept. 9
Brown, Jerry, Mrs.: Sept. 17
Brown, Roger, Mrs.: March 18
Buick, Roger: Oct. 8; Nov. 9
bulbul: July/Aug. 18
Burd, James: May 23
Bureau of Land Management: June 9
Bureau of Outdoor Recreation: June 20
Burger, William: Nov. 3, 11
Burton, Harry: April 3, 10, 15
"Bushman": Sept. 4; Nov. 25
butterfly: May 12

caiman: June 9
calamint: July/Aug. 11
*Calamogrostis canadensis:* July/Aug. 11
calciphile: July/Aug. 11
calculator: March 4
Calhoun, Louva: May 23
California condor (*Gymnogyps californianus*): Jan. 5
California falcon: Jan. 7
Calumet Sag Channel: July/Aug. 11
"Caemenid Land Snails of Western and Central Australia": March 7
Campbell, Susan: Sept. 12
Campoli, Anna: Nov. 23
Camunian Center for Prehistoric Studies (Centro Camuno di Studi Pristorici): Feb. 3
"Cannibals, Catalogs and Computers": Sept. 10
Cantu, Bob: Sept. 18
Capo di Monte, Italy: Feb. 3
Care and Use of Systematic Collections of Fishes: Sept. 3
"Caroline" (gorilla): Sept. 9
Carpenter, Charles H.: Oct. 18
Carter, Howard: April 2, 15, 19; May 4
Carter-De Vale, Sue: Oct. 5; Nov. 22
Cassidy, William: Feb. 15; March 16
Castrop, Julie: Nov. 25
*Catocala* (underwing moths): Feb. 16
cattail: July/Aug. 11
cemetery prairie: June 23
centipede (*Scolopendra morsitans*): Jan. 12
Cerro Zurqui, Costa Rica: Nov. 16
certified wildflower varieties: Jan. 7
Chan Chan: March 12
Chandra, Helen: Nov. 19
char (*Salvelinus*): May 19
*Check List of North American Noctuidae, Part I:* Feb. 16
cheetah (*Acinonyx jubatus*): Jan., p. 14
cherry: Jan. 4
Cheyenne Indians: Oct. 19
Chicago House (Luxor): Oct. 17
Chicago Park District: Oct. 3
*Chicagoland Birds, When and Where to Find Them:* May 5
Chicama Valley (Peru): March 13
Chilkat Indians: Nov. 20
Chimbote: June 13
Chimu empire: March 12; Dec. 3
China: Oct. 10
Christiansen, Carl: March 6; Oct. 6; Nov. 10
chromosome: May 12
cinerary urn, Roman: Feb. 2
clam, tridacna (*Tridacna derasa*): Jan. 12
Clark, Eugenie: Jan. 6
Clark, Shawna: Nov. 23
"Cloud Forests": Nov. 11

cloudberry: May 19
cockroach: Sept. 20
Collier, Donald: Sept. 12
columbaria: Sept. 2
*Columnea gloriosa:* Nov. 12
condor, California (*Gymnogyps californianus*): Jan. 5
"Cook's Tour": Nov. 24
Cooney, John: Feb. 13
cornhill agricultural plots: June 5
Costa Rica: Nov. 13
cowberry (*Vaccinium vitis-idaea*): May 19
crab, giant spider (*Macrocheira kaempferi*): Jan. 12
crocodile: June 9
crocodile, American (*Crocodylus acutus*): Jan. 5
crocodile, estuarine (saltwater)(*Crocodylus pocosus*): Jan. 12
cuckoo flower (*Cardamine pratensis palustris*): June 19
curlew: July/Aug. 12
Cuzco, Peru: Dec. 3

Dampier Peninsula (Australia): Nov. 6
Danilov, Victor: Oct. 3
David, Père Jean Pierre Armand: Oct. 10
Davis, Barbara: Sept. 12
Davis, Charles F.: May 5
Davis, O. C.: March 18
Davis, Ronald: May 8
de la Torre, Luis: Feb. 19
Deeds, Eric E.: March 13
deer, Pere David's: Oct. 10
Degen, Alan: Feb. 17
Deis, Betty: Sept. 18
dendrobatid frogs: July/Aug. 7
Derby, Australia: Oct. 7
*Deschampsia caespitosa:* July/Aug. 11
Desroches-Noblecourt, Christiane, Mme.: Feb. 13
Devil's Lake, Wis.: April 18
Dewitt nunatak: May 14
dingo (Australian wild dog): Nov. 6
Dobberstein, Dolores: Sept. 19
dolomite: July/Aug. 10
du Chaillu, Paul: Sept. 5
duck: May 19
Durrack Range, Australia: Nov. 9
Dybas, Henry: July/Aug. 15

eagle, bald: Jan. 8
eastern timber wolf: Sept. 21
echidna: Nov. 7
*Edaphasaurus:* July/Aug. 14
Edward E. Ayer Film/Lecture Series: Feb. 17
effigy mounds: June 5
Egypt Tours for Members: Oct. 17
Eighteenth Dynasty: April 6
electrum: April 10
elephant: Jan. 9
elephant seal: May 15
elephant, African (*Loxodonta africana africana*): Jan. 13
elephant, Asiatic (*Elephas maximus*): Jan. 14
"Elephants and the Art of Taxidermy": Jan. 9
*Elaphurus davidianus:* Oct. 12
Emas, Zoe: May 23
"Endangered and Threatened Species of the United States and Puerto Rico": June 10
endangered species: June 9
Endangered Species Act of 1973: June 9; Sept. 21, 22
Enga: June 7
Environmental Protection Agency (EPA): June 9
EPA (Environmental Protection Agency): June 9
Epigraphic Survey: Oct. 17
epiphyte: Nov. 13
Ertmann, Earl L.: Feb. 19
Eskimo curlew: July/Aug. 12
Espinosa, Paul: June 14
estuarine (saltwater) crocodile (*Crocodylus porosus*): Jan. 12
Evangelical Lutheran Church: May 7
"Exotic Fliers: Portraits of Neotropical Birds": July/Aug. 5
Exxon Corp.: April 3; June 3
"Eyes Have It, The": Jan. 10

falcon, California: Jan. 7
Feldman, Robert A.: June 12
felucca: Oct. 17
Fennoscandia: May 6
ferret: July/Aug. 18
Field Museum, opening day: June 8
*Fieldiana:* Jan. 15
Figel, Patty: Sept. 12
Finno-Ugric language family: May 6
fisher (mammal): Feb. 8
Fitzroy Crossing, Australia: Nov. 7
Fleming, Robert L., Jr.: Jan. 16
Fleming, Robert L., Sr.: Jan. 16
Flora of Costa Rica: Sept. 3
Florida manatee (*Trichechus manatus*): Jan. 5
Floristics of Veracruz: Sept. 3
Fort Center, Fla.: June 8
Fowler, Melvin: June 8
Fox, red (*Vulpes vulpes*): May 19
Freeman, Patricia: Oct. 5
Freimuth, Glen: June 4
frog, tree: July/Aug. 6
frogs: July/Aug. 7
fur seal: Jan. 4

Galip; *see* Lasisi, David
Gallatin, Albert: July/August. 13
gamelan: Oct. 5
"Gamelan Project: A Conservator's Challenge, The": Nov. 23
garden beds, prehistoric: June 4
Gayford, Peter: May 23
gecko: Sept. 20
Gemeente Museum (The Hague): Nov. 22
Geronimo: Oct. 18
gesneriads: Nov. 12
giant spider crab (*Macrocheira kaempferi*): Jan. 12
giant toad: July/Aug. 18
Gilpin, Orville: July/Aug. 14
Girardi, Betty Lou: May 23
golden hoary puccoon (*Lithospermum canescens*): June 2
Goliath beetle (*Goliathus goliathus*): Jan. 12, 14
Goliath frog (*Rana goliath*): Jan. 12
goose: May 19
*Gorgosaurus:* July/Aug. 14
gorillas: Sept. 4
"Gorillas in Captivity": Sept. 7
Grabowski, Kenneth John: Feb. 19
Granja, Reynaldo: Sept. 12
grass-of-Parnassus (*Parnassia glauca*): June 19
gray alder (*Alnus incana*): May 19
gray wolf: Sept. 21
Grays Lake National Wildlife Refuge: Sept. 23
"Great Scientific Debate of the 20th Century": March 3
great white shark (*Carcharadon carcharias*): Jan. 12
Greene, Peter: Sept. 10
Griffin, Donald R.: March 5
Grigelaitis, Vicki: Nov. 25
Gritis, Paul: May 23
grizzly bear: Jan. 3
Grote, A. R.: Feb. 16
grouse, willow (*Lagopus lagopus*): May 19
Grove, Samuel H.: Nov. 4
"Guests of Summer": July/Aug. 6
*Guide to Field Museum of Natural History:* July/Aug. 14
*Guinness Book of World Records:* Jan. 12
Guov'dageai'dno; *see* Kautokeino
Gurewitz, Sol: May 23
gynander: May 12
gynandromorph: May 12

Haida Indians: Nov. 20
Hales, Fleur: May 23
Hall, Fran William: Feb. 17
*Handbook of North American Birds:* May 5
Hanson, Philip: July/Aug. 10
hare, blue (*Lepus timidus*): May 19
Haremhab: April 7
Harper College; *see* William Rainey Harper College
Harper, Ken: May 15
Harris Extension: Nov. 26
Harris, James: Feb. 13
*Harvest of a Quiet Eye: The Natural World of John Burroughs:* May 5
Hatshepsut: April 11
heather: May 19
Heins, Ernst L.: Oct. 5; Nov. 22
Herman F. Strecker Lepidoptera collection: May 13
Hershkovitz, Philip: Nov. 4
*Heuchera richardsonii:* July/Aug. 11
Higinbotham, Harlow N.: March 2
Hiller, Audrey: Nov. 24
hoary puccoon, golden (*Lithospermum canescens*): June 2
Hogan, Ralph: May 23
Hollingsworth, W. E.: Sept. 16
Hopi Apartment: Sept. 2
Horicon Marsh (Wis.): March 18
Houston toad: Sept. 21
Houston Zoological Gardens: Sept. 8
Huaca de los Idolos: June 12
Huaca de los Sacrificios: June 15
Huaca del Sol: March 11
Huichol Indians: Feb. 17
Hulst, George D.: Feb. 16
hummingbird (*Heliactin cornuta*): Jan. 14
Hupa Indians: Nov. 21
Huy: April 11
Huysmans, Ferdinand: May 3
Hylidae: July/Aug. 7

Illinois Department of Conservation: June 18
Illinois Institute of Technology: Sept. 10
Illinois Natural Areas Inventory: July/Aug. 17

Illinois Nature Preserves Commission: June 18
"In Search of Meteorites": Sept. 14
Inca empire: March 12; June 15; Dec. 3
Indian paintbrush (*Castilleja coccinea*) June 2
Indiana bat (*Myotis sodalis*): Jan. 5
injurious wildlife, regulations on: July/Aug. p. 18
Instituto de Investigaciones Sobre Recursos Bioticos: Sept. 3
International Visitor Program: Oct. 4
Irvin, Frederica: May 23

"James Marvin Weller, 1899-1976": Feb. 18
Japanese white-eye: July/Aug. 18
jellyfish (*Cyanea arctica*): Jan. 12
Johnson, Florence: Oct. 14
Johnson, Ralph Gordon: July/Aug. 15
Johnson, Theodore: July/Aug. 6
Johnson, W. C.: Sept. 6
Joliet, Ill.: July/Aug. 13
Jolliet, Louis: July/Aug. 13
Jones, Doug: Feb. 17
Jones, Malcolm: May 23
Joyce Foundation: June 2

Karnak: April 6
Karok Indians: Nov. 21
Kautokeino (Guov'dageai'dno), Norway: May 6
Kavieng, New Ireland: Oct. 4
Keane, Richard V.: July/Aug. 5
Keller, Laurel E.: Oct. 8; Nov. 6
Kelly, A. R.: June 8
Kent, Lisa: Nov. 23
killer whale: May 15
Kimberley (Australia): Oct. 6
"Kimberley Snail Hunt—Round I": March 6
"Kimberley Snail Hunt—Rounds II through IV": Oct 6
"King Tut": April 6
Kitchener, Darryl: Oct. 8
Klemens, Eb: Sept. 12
Kolar, John: June 2
"Kolo" (gorilla): Sept. 8
Komodo monitor lizard (*Varanus komodoensis*): Jan. 12
Korbecki, Joyce A.: Feb. 2; Sept. 10
Korobkin, Marjorie: July/Aug. 14
Koss, Alan: Oct 18
Koss, Allan; *see* Koss, Alan
Krefeld (W. Germany) Zoo: Sept. 8
Krider, E. P.: Sept. 20
Krstolich, Joseph B.: Sept. 6
"Kumba" (gorilla): Sept. 8
Kus, James S.: March 13
Kwakiutl Indians: Nov. 20

La Cumbre Canal: March 13
La Grange Park Garden Club: June 2
Lacey Act: July/Aug. 18
Laestadian sect: May 7
Lake Erie: June 9
Lake Turkana, Kenya: Oct. 5
*Lambeosaurus:* July/Aug. 14
land snails: March 6; Oct. 6
Lapham, Increase: June 5
Lapps: May 6
largest animals, world's records: Jan. 12
Lasisi, David: Oct. 4
Lathrap, Donald W.: June 12
Laufer, Berthold: Jan. 19
lavaret whitefish (*Coregonus lavaretus*): May 19
Lawford Range (Australia): Nov. 9
leafy prairie clover: July/Aug. 16
Leakey, Richard E.: Oct. 5
*Legion of Night: The Underwing Moths:* Feb. 16
Lemont, Ill.: July/Aug. 10
Leonard, Anne: May 23
Leopold Range (Australia): Nov. 8
"Letters from Antarctica, 1976-77": Feb. 14
Levi-Setti, Matteo: Oct. 3
Levi-Setti, Nika Semkoff: July/Aug. 14; Oct. 3
Lewis University: July/Aug. 17
Lewis, Phillip: July/Aug. 14; Oct. 4
Lewis, Sally: Oct. 4
Library of Congress: Nov. 22
Liebman, Elizabeth: March 7, Oct. 7
"Life in Ancient Peru": June 12
lightning detection device: Sept 20
Lima (Peru): June 13
Lincoln Park Zoo: Sept 4, 7
Liston, Timothy: Sept. 12
little bluestem grass: July/Aug. 11
"Living Jewels of the Tropics": July/Aug. 7
*Living New World Monkeys (Platyrrhini):* Nov. 5
lobster, North Atlantic *(Homarus americanus):* Jan. 12
Lockport, Ill.: July/Aug. 11
locust swarms: Jan. 12
London Zoological Society: Oct. 12
long-billed curlew: July/Aug. 12
longest animals, world's records: Jan. 12
"Looking for Unimproved Land: The Illinois Natural Areas Inventory": June 18
Lossu, New Ireland: Oct. 4
Louisiana Purchase Exposition: *see* St. Louis Fair of 1904
Lukoschus, Fritz: Nov. 6
Lundy, Lois Bolton: Feb. 3
lynx: Sept. 22
*Lynx canadensis:* Sept. 22
*Lynx rufus:* Sept. 22
Lyons Township High School Conservation Club: June 2

McCarthy, William E.: Sept. 7
McCrone, Walter: Nov. 23
McMurdo Sound: Feb. 15
McMurdo Station: March 16; May 15
Madany, Mike: June 18
"Major Operation, A": Jan. 19
Malanggan: Oct. 4
"Mammal-Collecting in the Outback": Nov. 6
mammals, tertiary: March 7
mammoth: Jan. 9
manatee, Florida (*Trichechus manatus*): Jan. 5
*Manual of Neotropical Birds:* July/Aug. 2, 4
Marquette, Père: July/Aug. 13
Marshall, Larry Gene: Sept. 3
Martin, Ed: Sept. 12
Martin, Richard A.: Feb. 19
Martling, Margaret: May 23
"Massa" (gorilla): Sept. 9
Mauer, William J.: Sept. 3
Maya: April 11
Mazon Creek: July/Aug. 15
"Mbongo" (gorilla): Sept. 9
Members' Nights: July/Aug. 15; Oct. 5
Memphis (Egypt): April 10
metallophone: Nov. 22
meteorite: Feb. 14; March 16; May 14; Sept. 14
methiocarb: Jan. 4
Metropolitan Museum of Art: April 3
mice: Jan. 14
Michigan Department of Natural Resources: Feb. 12
Middle Woodland Period: June 6
midge (*Forcipomyia*): Jan. 14
Millar, John R.: July/Aug. 15
Miller, Marilyn J.: Sept. 10
millipede (*Graphidostreptus gigas*): Jan. 12
millipede (*Scaphistostrepus seychellarum):* Jan. 12
Milne Edwards, Alphonse: Oct. 10
Minnakht: April 6
Minnesota Public Interest Research Group (MPIRS): July/Aug. 19
Mirex pesticide: Jan. 6
Mitchell Plateau (Australia): March 7; Oct. 6; Nov. 10
Moche state: March 12
Moche Valley: March 12
"Modoc," longest-lived elephant: Jan. 14
Molina, Antonio: May 3
monadnock: April 18
Monahans, Tex.: Sept. 17
Monteverde Cloud Forest: Nov. 13
moraine: July/Aug. 11
Moran, Rob: June 20
Morell, Ross: June 8
Morris, Keith: Nov. 9
Moseley, Michael: March 10; July/Aug. 3; Dec. 3
moundbuilders: June 5
Mt. Erebus: March 16
Mt. Olga, Australia, Oct. 9
Mud Lake, Ill.: July/Aug. 13
Mueller, LeMoyne: May 23
*Muhlenbergia cuspidata:* July/Aug. 16
Muller, Kai: Feb. 17
Müller-Karpe, Michael: Nov. 3
mummies: Feb. 19
Munster, Roy: Nov. 8
Murnane, William J.: April 6
Mursili II: April 14
Museum "Journeys": Nov. 24
Mutnodjme: April 14
mynah: July/Aug. 18

Nadler, Ronald: Sept. 8
Nafertiti: April 7
Nakhtmin: April 14
Napier Downs Station, Australia: Oct. 7
Napier Range (Australia): Oct. 6
National Endowment for the Arts (NEA): Sept. 3, 10; Nov. 22
National Endowment for the Humanities: April 3
National Environmental Policy Act (NEPA): July/Aug. 19
National Land Institute of Rockford: June 18
national parks: Jan. 6
National Science Foundation (NSF): March 7, 12; July/Aug. 3; Sept. 3, 10; Nov. 3
National Science Foundation's Office of Polar Operations: Feb. 15

Natural Land Institute: June 20
Nature Conservancy: June 18
Navigato, Rocco D.: Sept. 2
NEA, *see* National Endowment for the Arts
Nebkheprure: April 7
Nelson Gallery-Atkins Museum of Fine Arts: May 3
"New Exhibit, 'Monkeys Inside and Out,' Heralds Publication of Monumental work by Philip Hershkovitz": Nov. 5
New Ireland: Oct. 4
Newberger, Natalie: Sept. 18
Nials, Fred L.: March 13
Ningbing Range (Australia): Oct. 6
Nininger, H. H.: Sept. 15
Nitecki, Matthew: Feb. 18; April 18; May 20; Nov. 3
Nootka Indians: Nov. 20
North American Indian Art: May 3
North Atlantic lobster (*Homarus americanus*): *Jan. 12*
*Norway: May 6*
*Numenius americana:* July/Aug. 12
*Numenius borealis:* July/Aug. 12

oak, black (*Quercus velutina*): June 22
O'Brien, John: May 22
ocean sunfish (*Mola mola*): Jan. 12
Ocker, Valerie: Sept. 14
octopus (*Octopus apollyon*): Jan. 12
Odessa, Tex., Sept. 17
Oglala Sioux Indians: Oct. 22
Oklahoma City Zoo: Sept. 9
Olsen, Edward: Feb. 14; March 16; April 18; May 14
"On Coming and Going in Saamiland": May 6
"On Your Own at Field Museum": Nov. 24
opposum, American (*Didelphis marsupialis*): Jan. 14
Ord River basin (Australia): Nov. 9
Oriental Institute: May 4
*Origins:* Oct. 5
Ornamental Horticulture Laboratory: June 8
Ortloff, Charles R.: March 13
Osborn, Dale J.: Oct. 10
Osgood, Wilfred H.: Oct. 6
osprey: Jan. 8
Ottawa National Forest: Feb. 8, 12
owl, spotted: June 9
Ozaki, Molly: Sept. 19

Pa-Aton-em-hab: April 11
Pahl, Marion: Nov. 4
paintbrush, Indian (*Castilleja coccinea*): June 2
PANDORA: Sept. 12
Paris Academy of Science: Oct. 10
Parker, Alfred E.: Sept. 6
Patuxent Wildlife Research Center: Sept. 23
Pawnee earth lodge: Oct. 18, 24; Nov. 26
Peacock, Elizabeth: Nov. 23
*Pedicularis lanceolata:* July/Aug. 11
Peking, China: Oct. 10
Pembroke Township: June 22
Penca: Nov. 23
penguin, Adélie: May 15
perching plants: Nov. 13
Père David's deer: Oct. 10
"Performing Arts in America, The": May 9
Perth, Australia: Oct. 7
Peru: March 10; June 12; Dec. 2, 3
"Peru's Golden Treasures" Dec. 3
Peske, G. Richard: June 6
*Petalostemum foliosum:* July/Aug. 16
Pfiffner, E. John: Nov. 4
"Phil" (gorilla): Sept. 9
phlox, purple prairie (*Phlox pilosa*): June 2
Phoenix, Ariz.: Sept. 17
Pilbara Region (Australia): Oct. 6
Pippin, Lonnie: March 13
Pitluga, Linton: Sept. 3
Pizarro, Francisco: Dec. 3
Place for Wonder, The: March 18; July/Aug. 3; Nov. 24
Plainview, Tex.: Sept. 16
poison-arrow frog: July/Aug. 7
pollution control-environmental conference: Jan. 7
Pomerantz, Louis: Oct. 5; Nov. 22
Pomo Indians: Oct. 19
Powell, Roger A.: Feb. 8
Pozorski, Shelia: March 13
Pozorski, Thomas: March 13
prairie alum root: July/Aug. 11
prairie cordgrass: July/Aug. 11
prairie dock (*Silphium terebinthinaceum*): June 19
prairie phlox, purple *(Phlox pilosa):* June 2
prairie satin grass: July/Aug. 16
prehispanic cultures of South America: March 12
"Prehistoric Agriculture in the Upper Midwest": June 4
Price, Laurie: March 6; Oct. 6; Nov. 10
Prince Regent River basin: March 7
Programa Riego Antiguo (Ancient Irrigation Program): March 10
pronghorn antelope *(Antilocapra americana):* Jan 14
Ptah: April 10, 13 14
ptarmigan *(Lagopus scoticus):* May 19
puccoon, golden hoary *(Lithospermum canescens):* June 2
purple angelica: July/Aug. 11
purple prairie phlox *(Phlox pilosa):* June 2
python, reticulated *(Python reticulatus):* Jan. 12

quartzite: April 18
Queen Fabiola Mountains (Australia): Feb. 14
Quetico canoe trip for members: April 18
Quimby, George Irving: June 6

Rabineau, Phyllis: Sept. 10
Rada, M. E.: May 23
Radin, Paul: June 6
Raptor Information Center: Sept. 23
rat, black *(Rattus rattus):* Nov. 7
rats: Jan. 14
*Rattus rattus* (black rat): Nov. 7
Ray A. Kroc Environmental Fund: March 7
Re: April 10
Rea, Dorothy: March 2
"Rebirth of the Gamelan": Nov. 22
red fox *(Vulpes vulpes):* May 19
red tide: June 13
Redford, Donald B.: Feb. 13
reindeer: May 10
*Remarks Upon the Genus Catocala, with a Catalogue of Species and Accompanying Notes:* Feb. 16
*Resident Birds of Chicago:* May 5
reticulated python *(Python reticulatus):* Jan. 12
Rettig, Neil: Feb. 17
ribbon worm *(Lineus longissimus):* Jan. 12
Richardson, Eugene S.: July/Aug. 15
Riley, Thomas J.: June 4
Rio Moche: March 12
Robert Wood Johnson Jr. Charitable Trust: April 3; June 3
Robinson, Eddie: Sept. 5
Roder, Dorothy: April 18
Romeoville, Ill.: July/Aug. 12
Roseman, Stanley: May 6
Ross Island: March 16
Ross Sound: March 16
Ross, Ann: Sept. 18
Royal Society Range: March 16
Russian sturgeon *(Acipenser huso):* Jan. 12
rustlers (cactus): Sept. 21
rustlers (tree): Sept. 20

Saami: May 6
Saamiland: May 6
Sacred Circles—2,000 Years of North American Art: May 3
Sag Valley: July/Aug. 11
St. Cosme, Jean: July/Aug. 13
St. Louis Fair of 1904: Oct. 18
Salish Indians: Nov. 20
salmon, Atlantic *(Salmo salar):* May 19
saltwater crocodile *(Crocodylus porosus):* Jan. 12
Sanborn, Colin Campbell: Sept. 4
Sarasan, Lenore: Sept. 10
Sargent, Theodore D.: *Legion of Night: The Underwing Moths* (book review): Feb. 16
saron: Nov. 22
Sassoonian, Manu: May 6
*Satureja arkansana:* July/Aug. 11
Savage, Thomas S.: Sept. 4
Save the Prairie Society: June 2
Save the Valley: July/Aug. 17
Savi's white-toothed pygmy shrew *(Suncus etruscus):* Jan. 13
Schmidt, Karl P.: July/Aug. 15
Scholl, Carol: Sept. 19; Nov. 24
Schoolcraft, Henry: June 5
Schramm, Frederick R.: July/Aug. 15
Schumacher, Carole: May 23
scorpion, sea *(Pterygotus buffaloensis):* Jan. 12
Scott, Nora: Feb. 13
sea scorpion *(Pterygotus buffaloensis):* Jan. 12
seal, elephant: May 15
seal, fur: Jan. 4
seal, Weddell: May 15
seashell *Spondylus):* June 14
Service Club of Chicago: March 18
Shang dynasty: Oct. 10
Shannon, Rick: Sept. 3; Nov. 19
shark repellent: Jan. 6
Shatzel, Dennis: May 15
Shawabty (Tutankhamun): April, 4, 6
shrew, Savi's white-toothed pygmy *(Suncus etruscus):* Jan. 13
side oats grama grass: July/Aug. 11
Sierra Madre: Feb. 17
*sii'da:* May, 10
silkworm *(Bombyx mori):* May 13
"Silver Anniversary for Bushman": Sept. 4
Silverman, David P.: Feb. 19

Sinai reefs: Feb. 17
Sinbad (gorilla): Sept. 9
Singer, Ronald: Nov. 4
Singh Bangdel: Jan. 16
Sioux: Oct. 22
Sipiera, Paul: Sept. 14
Skinner, Donald: March 18
skua: March 19; May 15
Slack-Smith, Shirley: Oct. 6
Slatick, Eugene R., "The Eyes Have It": Jan. 10
Smenkhkara: April 7
Smith, Ellen Thorne (Mrs. Hermon Dunlap Smith): May 5
Smith, Harriet M.: Feb. 19; May 3; July/Aug. 14
Smith, Hermon Dunlap, Mrs. (Ellen Thorne Smith): May 5
snails: Oct. 6
snails, land: March 6
"Snowflake" (gorilla): Sept. 7
snowmobile: May 19
*Sociobiology: The New Synthesis:* March 3
Solem, Alan: March 6; Oct. 6; Nov. 3
Sonoran Desert: Feb. 17
sorrel *(Oxyria digyna):* May 19
sorrel *(Rumex acetosa):* May 19
Soule, Thayer: Feb. 17
South African springbok *(Antidorcas marsupialis):* Jan. 14
South Pole: Feb. 15; March 16
*Spartina pectinata:* July/Aug. 11
Spicehandler, Judith: Nov. 23
spider, bird-eating *(Theraphosa leblondi):* Jan. 12
*Spondylus* seashell: June 14
spotted owl: June 9
springbok, South African *(Antidorcas marsupialis):* Jan. 14
squid, Atlantic giant *(Architeuthis sp.):* Jan. 12, 13
starling: July/Aug. 18
Starved Rock: Weekend Geology Field Trip for Members: April 18
Stein, Llois: May 23
Stephens, Lorain: May 23
stick insect *(Parnacia serratipes):* Jan. 12
stoat: July/Aug. 18
stone turtle: Jan. 19
Strecker, Herman. F.: Feb. 16; May 13
Street, Janice: Nov. 6
Street, William S.: Nov. 6
sturgeon, Russian *(Acipenser huso):* Jan. 12
sulfur-bottomed, or blue, whale *(Balaenoptera musculus):* Jan. 13
Sumerian stag: Nov. 3
*Sundanese Gamelan: A Gestalt Approach to Organology,* A: Nov. 22
sunfish, ocean *(Mola mola):* Jan. 12
Superior National Forest: Feb. 8; April 18
Suppiluliumma: April 14
swallowtail *(Papilio machaon):* Jan. 14
swallowtail, tiger *(Papilio glaucus):* May 12
swamp betony: July/Aug. 11
Swartchild, Jim: May 23
Swink, Floyd: July/Aug. 6
Swink, Marie: July/Aug. 6
Sylvester, William: Feb. 17

taxidermy: Jan. 9
Tel Aviv Zoo: Sept. 9
Telling, Edward R.: Sept. 3
Tenami Desert, Australia: Oct. 9
Tennessee milk vetch: July/Aug. 17
Terrell, John: March 3; Feb. 19; Sept. 13; Nov. 3
Tertiary mammals: March 7
Thebes: April 6
Thomas, P.: Nov. 10
Thompson, Governor James R.: Oct. 3
threatened species: June 10
Thutmose I: April 11
Thutmose II: April 11
Thutmose III: April 11
Thutmose IV: April 11
Tickets to the World's Columbian Exposition of 1893: March, cover illustration, 2
tide, red: June 13
tiger swallowtail *(Papilio glaucus):* May 12
"Tigers Without Their Stripes": May 12
till: July/Aug. 11
timber wolf: Sept. 21
Tiyi: April 11
Tlingit Indians: Nov. 20
Topeng Babakan: Nov. 23
toucan: July/Aug. 2
toucanet: July/Aug. 2
Trans-Antarctic Mountains: May 14
Traylor, Melvin: Jan. 16
"Treasures of the Des Plaines": July/Aug. 10
"Treasures of Tutankhamun": Feb. 19; April 6; June 3
Treasures of Tutankhamun Dinner-Lecture Series: Feb. 13
tree frog: July/Aug. 6
tree rustlers: Sept. 20
tridacna clam *(Tridacna derasa):* Jan. 12
*Troglodytes gorilla:* Sept. 4
trout *(Salmo):* May 19
Trustees, Board of: March 18
Tsimshian Indians: Nov. 20
Tudor, Guy: July/Aug. 2, 5
tufted hair grass: July/Aug. 11
Turnbull, William: March 7; July/Aug. 14
Turner, Ronald W.: Sept. 3; Nov. 3
Turumiquire, Mt.: July/Aug. 5
Tutankhamun: April 6; May 4; July/Aug. 10; Oct. 14, 16
Tutankhaton: April 7
Twomey, Arthur: Feb. 17
*Typha latifolia:* July/Aug. 11

Umstot, Dick: Sept. 14
"Uniguide": Oct. 3; Nov. 25
United States Antarctic Research Program (USARP): Feb. 15
United States Forest Service: Feb. 12
University of Chicago: April 3
University of Illinois: June 6
Urban, Helen: Nov. 23

"Valcamonica: World's Richest Treasury of Rock Carvings": Feb. 3
Valdivia culture: June 17
vampire bat: July/Aug. 18
VanStone, James: Nov. 19
vegetation sampling: June 23
Victoria Land: May 14
vision in birds: Jan. 10
volunteers: May 22
"Volunteers honored": May 22
Vondriska, Jean: Sept. 19
Voris, Harold: May 23
Vostok: Feb. 15
Voyageur Wilderness Program: April 18

Waddington, C. H.: March 3
wallaby: Nov. 8
Wallace, Snow: Nov. 6
walnut trees: Sept. 21
Walsten, David: May 12; July/Aug. 7
Walter E. Heller Foundation: Nov. 23
Walters, Leon L.: Sept. 6
Ware, James, Mrs.: March 18
"Warp of Cedar, Weft of Spruce": Nov. 19
Warshawsky, Louis: Sept. 12
Waterman, Stanton: Feb. 17
"Waterways of Ancient Peru": March 10
weasel: July/Aug. 18
weasel family: Feb. 8
Webber, E. Leland: May 22; Oct. 3; Nov. 22
Weber, Ron: Nov. 19
Weddell, Eric: June 7
Weddell seal: May 15
wedge-prism: June 23
Weekend Geology Field Trips for Members: April 18; May 20
Weiland, Richard: Sept. 10
Weiss, David: May 22
Weller, James M.: Feb. 18
Wells, Fred: Oct. 6
Wenzel, Rupert L.: July/Aug. 14; Nov. 3
Western Australia: Oct. 6
Western Australian Field Program: March 6; Nov. 6
Western Australian Museum: Nov. 10
whale shark *(Rhiniodon typus):* Jan. 12
whale, killer: May 15
"What's the Weight, by the Way, of a Quarter-Trillion Locusts?": Jan. 12
Whitaker, John O.: Nov. 10
White, Jack: June 21
whitefish, lavaret *(Coregonus lavaretus):* May 19
whooping crane: Sept. 23
Wilderness Canoe Trip, Third Annual: April 18
wildflower varieties, certified: Jan. 7
Wildlife Management Institute: June 9
Will County, Ill.: July/Aug. 12
William Rainey Harper College: Sept. 16
willow *(Salix caprea):* May 19
willow grouse *(Lagopus lagopus):* May 19
Willow Springs, Ill.: July/Aug. 10
Wilson, Barry: Oct. 6
Wilson, Edward O.: March 3
Wilson, J. L.: Sept. 4
Wilson, Keith: June 19
Winnebago Indians: June 6
Woburn Park Abbey: Oct. 12
wolf: Sept. 21
Wolf Road Prairie: June 2
wolf, eastern timber: Jan. 8
Wolf, George: Sept. 12
Wonder, Frank C.: Sept. 6
World's Columbian Exposition of 1893: March 2; Oct. 5
Wright Upper Glacier: March 16
Wright, H. E., Jr.: July/Aug. 19
Wyman, Jeffries: Sept. 4

Yamato Mountains: May 14
Yamato Mountains meteorites: Feb. 14; May 14
Yanai, Keiso: March 16
Yanos, George: June 6
Yurok Indians: Nov. 21

*(Continued from p. 9)*

The artist was well informed about the structure of gamelan music and was probably a gamelan musician himself. We know this because his design of the instruments depicts a relationship between music and philosophy: The tiger-lion *saron* comprise a family, the nucleus of society; the musical function of these six instruments is to play the nuclear melody of a *gending*, or gamelan composition, in its purest form. An even more remarkable example of this expressed relationship between music and philosophy may be seen in the design of the gongstand. On this piece, the artist carved the gate to the upperworld and the tree of life, complete with branches, foliage, flowers, and root. The tree is the source of life from which man is born, and to which he returns after death. The gong is the source of music; and all music arises from and returns to it.

The more I thought about it, the more such instruments seemed to reflect their musical function. The artist had presented a philosophic cosmic concept in a musical context, and this led me to wonder if there might be a cosmic structure hidden in the structure of gamelan music itself. I found my answer in the numerical principles inherent to the cosmic tree of life—principles said to underlie the balance of nature that pervades all elements of Javanese culture, including their concept of time, their sense of direction, and their sense of symmetry in art and dance. These numerical principles are present in the design of the 1893 gamelan, and they dictate the fundamental structure of gamelan music.

The tree of life is symmetrical. When represented two-dimensionally, it has an even number of branches growing from its trunk, so that the right and left sides are symmetrical. Three-dimensional images of the tree always bear at least four branches, representing the four primary directions. As the tree grows, the number of branches increases to 8, then 16, then 32, and so on, doubling with each increment, so that the compass is always equally divided. *(See diagrams on page 12.)*

This same numerology is seen in the right and left branches of the gongstand and in the pairs of tiger-lions, each with two heads and four serpents (two on each side). It is also seen in the four instruments of the *bonang* family, with the carved branches carrying a total of 16 birds.

The colotomic (underlying) structure of gamelan music exhibits an identical numerical principle. In every composition, the nuclear melody is divided into gong phrases, each signaled by a stroke of the big gong. Depending on the form of the nuclear melody, the number of equal-length beats in a gong phrase will be 8 or 16 or 32 or 64, and so on. The gong phrases are further subdivided by the *kenong*, *ketuk*, and *kempul*, the punctuating colotomic instruments. Each gong phrase is divided into fourths by the *kenong* and *kempul*, and into eighths by the *ketuk*, with each instrument sounding its own predetermined pattern.

For example, in a Javanese piece with 16-beat gong phrases, the *kenong* sounds on beats 4, 8, 12, and 16; the *kempul* on beats 6, 10, 14; the *ketuk* on 1, 3, 5, 7, 9, 11, 13, and 15. (The *kempul*, on beat 2, is implied but not played because the big gong is still ringing.) This same pattern becomes the colotomic cycle for each 16-beat phrase in the piece.

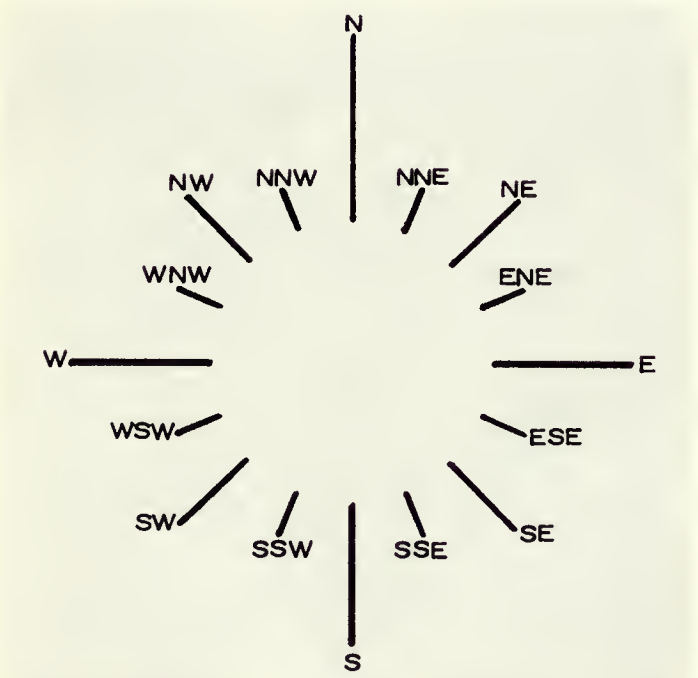
Sarons, *or bronze metallophones in the form of tiger-lions, representing (top to bottom) childhood, maturity, and old age. Each is one of a pair in the 1893 gamelan. See p. 9 for discussion. (Lengths: 78, 91, 93 cm.)*

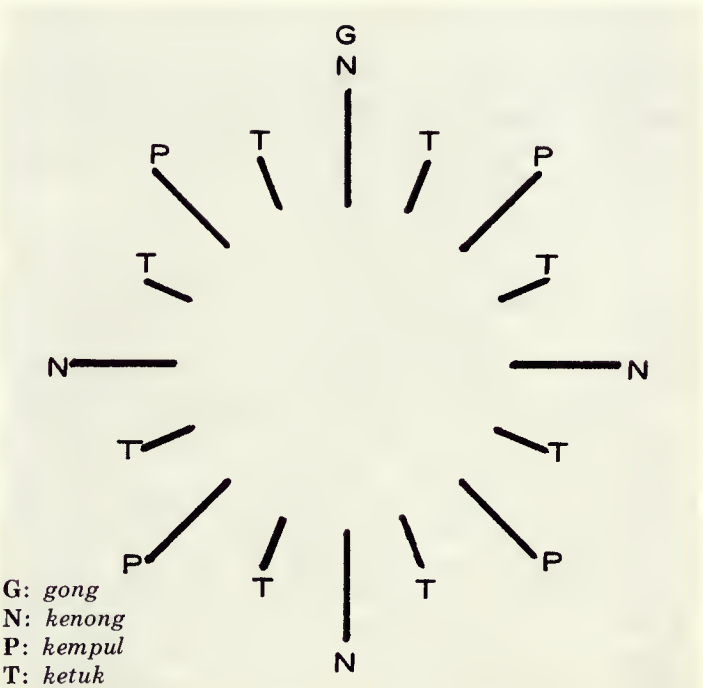
A diagrammed colotomic cycle, drawn in a circle, can be seen to replicate the organization of the tree of life, with the direction and number of its branches equally representing the points and subpoints of the compass. Thus, the structure of gamelan music through time, parallels the structure of the tree of life in space.

In designing the frames, stands, and resonators of the 1893 gamelan, the unknown artist presented the innermost being of his people. He created a representation of the Javanese cosmos—a complex symbolism inseparable from the structure of the music itself. For more than 84 years this very special gamelan has been silent. Now, with its beauty fully restored, it sings for us again.

Bonang barung, *set of 14 pot gongs. Length 198 cm. (Detail shown on p. 3.)*

Suling, *a Central Javanese flute, with six finger holes. Length 32 cm.*




**G**: *gong*
**N**: *kenong*
**P**: *kempul*
**T**: *ketuk*

*The design of Field Museum's gamelan reflects a numerical relationship between Javanese cosmology and the structure of Javanese music. The colotomic cycle of a 16-beat gong phrase (right) with four instruments participating through time, parallels the structure of a 16-point compass rose (left), which may also be visualized as the branches of the tree of life in space.*

*Corner of conservation lab, showing several gamelan instruments in various stages of restoration.*

# RESTORATION OF THE GAMELAN

**By Louis Pomerantz** *Photos by the author*

I first saw the Field Museum gamelan in October 1976, when Bennet Bronson, associate curator of Asian archaeology and ethnology, led me to the "Pacific research lab," a huge ground-floor storeroom filled with fascinating artifacts from faraway shores. The purpose of my visit was to decide if I were interested in restoring these ancient Javanese instruments, a project for which the Museum had already received a grant from the National Endowment for the Arts.

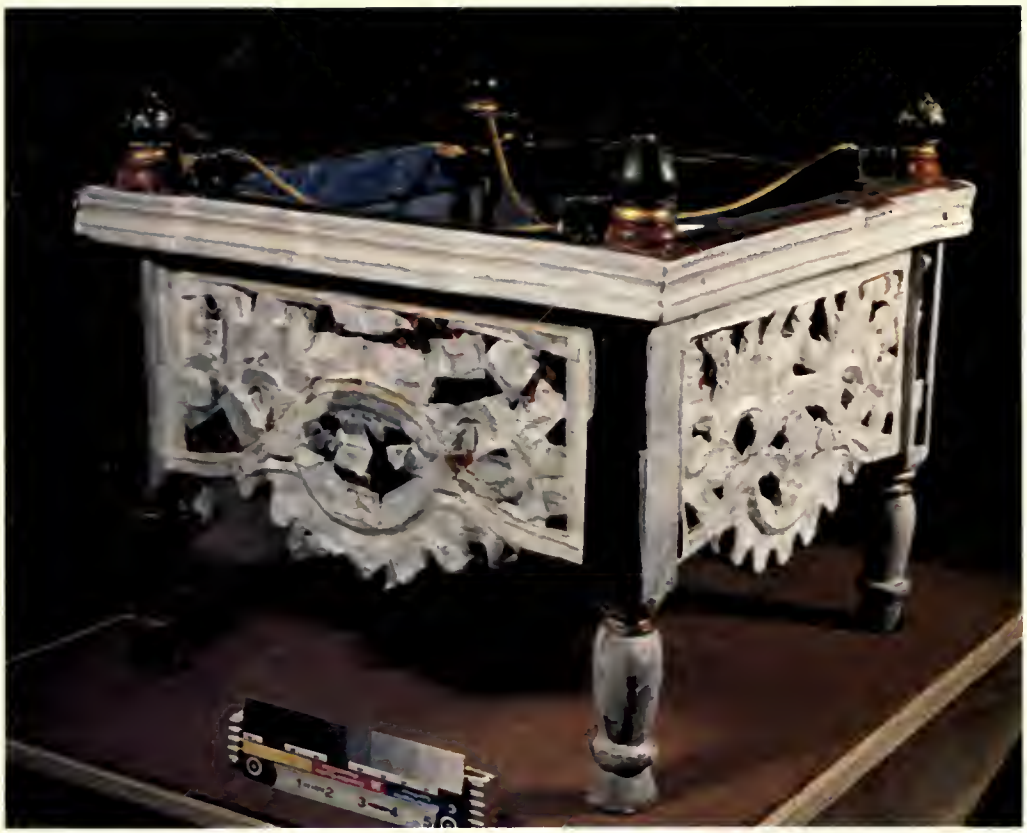
There, resting on storage tables and desk tops, the instruments were a curious assemblage, fashioned in a variety of shapes: drums of hollowed tree trunks covered top and bottom with stretched skins; xylophones of wood and bronze bars that were supported on the backs of double-headed, sculptured tiger-lions; bronze gongs up to 36 inches in diameter; long, couchlike frames for supporting sets of bronze gong chimes; a finely carved dragon sporting bent-nail fangs and serving as a support for a two-stringed fiddle; numerous wooden beaters tipped with leather or covered with fabric. All of these exotic instruments were part of a 24-piece orchestra from the island of Java; now more than 130 years old, they had been brought to Chicago in 1893 for the World's Columbian Exposition.

My reaction on first seeing the collection was mixed. The deteriorated condition of the instruments and the variety of materials used in their construction presented a formidable challenge. These marvelous polychromed wood carvings supporting ranks of gongs and bars must have been an arresting sight at the exposition. It would be enormously satisfying to restore them to life.

Caught in the gamelan's "spell," I immediately immersed myself in studying methods and materials required for a detailed restoration. It was obvious that the 130 dismantled bits and pieces of tarnished bronze would need cleaning; but just how extensively this was to be done had to be decided in consultation with Ben Bronson and Sue Carter-De Vale (the gamelan project program and research director, who had written her doctoral dissertation on the gamelan), since cleaning involved impor-

---

*Louis Pomerantz, a renowned art conservator, is special conservator for the gamelan project.*



Kenong *stand, like a patient swathed in bandages, is nearly covered with wet-strength tissue paper which has been treated with hot gelatine adhesive. After the adhesive has dried—rebinding the original paint film to the wood surface—the paper is removed. Cleaning and restoration of this stand required hundreds of hours of meticulous work.*

tant aesthetic considerations and a knowledge of Javanese culture, tradition, and custom.

Polishing materials would have to be safe for application on whatever object was involved, and required a preliminary chemical analysis. Exactly how to treat the badly flaked paint on the wooden surfaces had to be researched. Adhesives to be employed would depend on the kind of paint and binding media already present, as well as the way in which these elements were layered. If the paint responded safely to heat, a thermoplastic adhesive could be used. If the paint was water-resistant, an aqueous adhesive would be considered. If this proved unsafe, then a resin/solvent type of adhesive might be suitable. If use of the latter was indicated, it would be necessary to find a resin which was soluble in a solvent that would not dissolve the original paint. It was also possible that a combination of any of these choices might work. What was initially required, then, was a chemical analysis of the binding media and pigments.

Once the flaking paint was rebonded, it would then be safe to clean the surface without the danger of additional paint loss. The surfaces to be cleaned were densely layered with murky varnish and grime, all of which had to be removed. Solubility of these substances would have to be determined and a solvent chosen which would not harm the paint underneath.

Whatever materials and techniques were to be employed, it was also essential that our procedures be reversible: the materials should be removable without harming or endangering the original structure. Once the original paint films were securely bonded and the cleaning completed, structural repairs could then be under-

*the three pairs of* saron, *or tiger-lion metallophones, as they were in storage, prior to restoration.*

taken. After this, missing paint would be restored by filling and inpainting (retouching only in the areas of losses). As a safety factor, the latter could be done after varnishing. This was the order in which the project actually proceeded.

To make a detailed analysis of the pigments, binding media, varnish, metal, and metal polish, we were fortunate in securing the services of Chicagoan Walter C. McCrone, an internationally recognized analytical microscopist. Eight wood samples were sent to the U.S. Forest Products Laboratory, in Madison, Wis., where they were studied by Robert C. Koeppen, a specialist in plant structure and wood identification.

While McCrone and Koeppen did their analyses, I tested various adhesives and solvents for their safety as well as effectiveness. The test results on the polish proved it to be excellent for the bronze. McCrone's electron microprobe analysis of gongs and brass bars showed they were similar to one another in composition: approximately 70 percent copper and 30 percent tin, except for two small gongs, one containing 3 percent lead and the other containing about 78 percent copper and 20 percent tin, suggesting that they may have been made at a different time or place than the others. McCrone also analyzed the gold leaf and the metal backing of the mirror glass.

Identification of the many paint samples was done by polarized light microscopy and electron microprobe. McCrone's analysis of 130 paint samples revealed four white pigments, two yellows, two greens, a brown, a black, a red, and a blue. The newest of them, synthetic ultramarine blue, was introduced in 1824, thus proving conclusively that the instruments were painted sometime after that date.

Many of the instruments are decorated with small squares or circles of mirror glass. To the unaided eye, their sparkle seemed to emanate from slivers of mica, but analysis showed they were composed of layers of lead, glass, and paper. Especially significant to us was the fact that all instruments were coated with multiple paint layers, in some cases as many as seven. Ordinarily, this would suggest they had been repainted at later times—a common happening with western polychromed sculpture. Such a condition of paint layers applied at great intervals of time would require, then, that the upper layers be stripped away to reveal the original, bottom layer.

Sue De Vale, however, explained to me that Indonesian puppets are painted only in certain colors, and these in a prescribed sequence. In discussing this same procedure in his book on Javanese puppets, R. L. Mellema noted "This means in practice that one has to choose carefully to match friendly colors with each other, and to avoid related tints . . . each color has its own specific friendly color, *e.g.*, red has to be matched with green, and orange with blue . . ."* To recognize that these multicolored paint films were original and not later additions was thus important, and underscored the need for close collaboration between the conservator and those with a knowledge of Javanese culture.

McCrone's infrared absorption analysis of the varnish indicated a Siamese shellac that was soluble in ethyl

*Wayang Puppets, Carving, Coloring, and Symbolism, *by R. L. Mellema, published by the Royal Tropical Institute, Amsterdam, 1954.*

*Conservator Louis Pomerantz at work on* saron, *or metallophone, stand.*

*Gamelan conservation volunteers (clockwise from upper right): Helen Urban, Dodie Baumgarten, Rae Barnett, Judith Spicehandler, Anna Campoli, and Elizabeth Peacock.*

alcohol. The wood samples were identified as jackfruit (*Artocarpus*), pine, teak (*Tectonia*), a monocotyledon of unknown genus with a soft, pithy stalk, and a leguminous tree (*Albizia?*).

Scrapings of varnish containing an insoluble grit were sent to McCrone in hopes that their geographic origin could be pinpointed. This information, in turn, might tell us where the shellac had been applied—whether in Indonesia, the United States, or elsewhere. Disappointingly, the analysis showed "a wide variety of particulate debris including sand, limestone, feldspar, mica, fibers of linen, paper, and cotton, nothing unique about them . . ." —simple air pollution ingredients of a universal sort!

During the course of our work—aided and abetted

*One of many delicate restoration processes: the cleaning of gold leaf. (1) Wet-strength tissue is placed on area to be treated. (2) Solvent is applied. (3) Excess solvent is blotted. (4) Blotter is removed, showing how darkened shellac varnish has been absorbed by wet-strength tissue.*

by volunteers, who were in fact indispensable—it was often necessary to improvise techniques as we encountered special problems.* One such problem was how to clean the porous surface of gold leaf. This required extreme delicacy, because the gold leaf, insoluble in ethyl alcohol, (used to remove the darkened shellac varnish), was underpainted with vermillion, a substance that *was* soluble in the alcohol. We overcame this difficulty by applying strips of wet-strength tissue paper and blotter paper soaked in alcohol. This absorbed the shellac as the alcohol dissolved it, leaving both the vermillion and the gold leaf unharmed.

In many areas where the edges of carved figures were covered with paint, shrinkage of the underlying wood had created lacunae, or spaces, between paint and wood. When adhesive was applied and the paint pressed flat there would then be insufficient surface space for the paint; a loss of paint would result. To prevent this, we tried stuffing the lacunae with tiny strips of wet-strength paper, then moistening the paper with a hot gelatine adhesive. It worked like a charm! And its success more than compensated for the delicate maneuverings required.

In some instances, we were obliged to substitute modern materials for original materials that had badly deteriorated. For example, decomposed strips of a monocot wood that lay beneath the bronze xylophone bars were replaced with balsa wood. Woven cloth strips that acted as buffers between the monocot and the bronze bars were replaced with strips of pure wool. Nails securing the xylophone bars were covered with heat-shrinkable polyvinyl chloride (PVC) tubing. Missing fragments of wood carving were replaced with custom-carved balsa. Crudely nailed repairs of the past were rejoined with carpenter's glue. Sherwin-Williams Company chemists A.P. Wagener and John W. Huffman tested the bronze pieces and, on their recommendation, we treated the pieces with a .2 per-

*The gamelan project volunteers assisting in the restoration and conservation were Christine Abiera, Rae Barnett, Dodie Baumgarten, Anna Campoli, Shawna Clark, Lisa Kent, Elizabeth Peacock, Judith Spicehandler, and Helen Urban.

*Sue Carter-De Vale, gamelan program and research director, checking the pitch of a key on a* peking *(smallest tiger-lion* saron, *or metallophone).*

cent solution of benzotriazole in isopropanol ("Cobratec"), which is expected to preserve their shine and protect them from tarnish for years to come.

Tuning of the instruments was a major undertaking performed by Ernst L. Heins, a specialist in Javanese music at the University of Amsterdam, and Sue Carter-De Vale. Metallophones are tuned by filing the keys; gongs are tuned by hammering or by adding wax to the small "knobs" (bosses) on top. I suggested a method of using microcrystalline wax. This proved successful, and eliminated the need to hammer the gongs. Hammering, by changing the metal's thickness, alters the sound. Thus, it is a very tricky business that may crack the gong, and has traditionally required the skills of a Javanese specialist. A wax used on the gongs in the past had become brittle and either fallen out completely or partly separated from the bronze surface. The remaining fragments caused undesirable vibrations or sound that decayed too quickly in musical tone.

As we proceeded with the restoration process, photographs were taken to document the original condition of the instruments and details revealing original methods of manufacture, as well as step-by-step restoration treatments. Thus, hundreds of 35mm slides are now part of the documented record of how these rare and beautiful instruments were resurrected.

*Various pot gongs, inverted, showing old wax (lower left) and recently added microcrystalline wax. The use of microcrystalline wax in tuning the gongs was devised by Pomerantz and initiated by Ernst Heins, University of Amsterdam musicologist.*

# *January & February at Field Museum*

*(January 15 through February 15)*

### New Exhibits

**Field Museum Gamelan**—opens January 15. Field Museum's Javanese gamelan, an ensemble of 24 fine bronze and wood musical instruments, has been completely restored for exhibition. It is the oldest and perhaps finest gamelan outside Indonesia. An audio tape supplements this permanent exhibit. Hall K, ground floor.

**Peru's Golden Treasures**—Members' preview February 15. (Opens to public Feb. 16.) A special exhibit of 225 pre-Columbian gold artifacts, on loan from the Museo Oro del Peru, Lima, comprise the largest collection of its kind ever shown in the United States. The exhibit is augmented by more than 50 antiquities from Field Museum's own collections and from the Peabody Museum at Harvard University. Hall 27, 2nd floor. Through May 21.

*Cradle of Haida tribe made of spruce root. On view with other Northwest Coast basketry pieces in Hall 27.*

**Monkeys Inside and Out.** Exhibit of illustrations of monkeys appearing in the recently published *Living New World Monkeys*, Vol. 1, by Philip Hershkovitz, emeritus curator of mammals. Hall 9. No closing date.

**Exotic Flyers: Portraits of Neotropical Birds.** Exhibit of exquisite bird illustrations appearing in the recently published *Manual of Neotropical Birds*, Vol. 1, by Emmet R. Blake, emeritus curator of birds. Hall 9. No closing date.

**Basketry of the Northwest Coast Indians.** This exhibit features 100 basketry items made mostly around 1900 by Indians of the Northwest Coast (southwestern Alaska to northern California). The three major basketry techniques of plaiting, twining, and coiling are represented, along with the raw materials and tools used. Hall 27, 2nd floor.

### New Programs

**Papua New Guinea: Twilight of Eden**—January 29. The Illinois Audubon Society presents a free film/lecture about the world's largest island at 2:30 p.m. in Simpson Theatre, ground floor west.

### Continuing

**Winter Journey for Children: Hidden Faces.** Self-guided tour leads children through museum exhibits to learn about masks and their uses in different cultures. Free *Journey* pamphlets available at information booth, main floor. Through January 31.

**The Place for Wonder.** This gallery provides a place to handle, sort, and compare artifacts and specimens. Weekdays, 1:00 p.m. to 3:00 p.m.; weekends, 10:00 a.m. to noon and 1:00 p.m. to 3:00 p.m.

**The Ancient Art of Weaving.** Weaving and spinning demonstrations every Monday, Wednesday, and Friday, 10:00 a.m. to noon. South Lounge, 2nd floor.

**Male and Female: Anthropology Game.** The exhibit where visitors become anthropologists. Discover that economic and social roles of the sexes are not universally the same. Ground floor. No closing date.

**On Your Own at Field Museum.** Self-guided tour booklets, adult- and family-oriented, available for 25c at entrance to the Museum Shop, main floor north.

**Weekend Discovery Programs.** Guided tours, demonstrations, and participatory museum-related activities. Every Saturday and Sunday, 10:00 a.m. to 3:00 p.m.

**Audio Information System.** The museum's newly installed audio system, *Uniguide*, enables visitors of all ages to visit selected exhibits in any sequence. Audio receivers and maps available for $1.25 per person, $3.75 for a family of up to 5 at the entrance to the Museum Shop, main floor north.

*Calendar continued on back cover*

MISS EDITH FLEMING
946 PLEASANT STREET
OAK PARK ILL 60302

# *January & February at Field Museum*

*(CALENDAR continued from inside back cover)*

*Figures atop new Pawnee earth lodge, Hall 5* — *Ron Testa*

**Pawnee Earth Lodge.** Field Museum's newest permanent exhibit, in Hall 5, is a traditional Pawnee earth lodge—the home and ceremonial center of Pawnee Indians as it existed in the mid-1800s. Daily programs provide opportunities to learn about Pawnee culture. Public programs: Monday through Friday, 12:30 p.m.; weekends, 11:15 a.m., and 12:30 p.m. Beginning in February: Monday through Friday, 1:15 p.m.; weekends, 11:00 a.m. and 1:15 p.m. Tickets may be picked up 15 minutes prior to the program at the North information booth. Programs are limited to 30 people.

**January and February Hours**
*(through February 15)*

**The Museum Opens** daily at 9:00 a.m. and closes at 4:00 p.m. Monday through Thursday; Saturdays and Sundays, 5:00 p.m. On Fridays the museum is open to 9:00 p.m.

**The Museum Library** is open weekdays 9:00 a.m. to 4:00 p.m. Obtain a pass at reception desk, main floor.

**Museum telephone:** 922-9410.

February
1978

Field Museum of Natural History Bulletin

# PERU'S GOLDEN TREASURES

## *Members' Preview*

*Wednesday, Feb. 15, 10 a.m. to 10 p.m.*

**Field Museum of Natural History Bulletin**

February, 1978
Vol. 49, No. 2

*Editor/Designer:* **David M. Walsten**
*Production:* **Oscar Anderson**
*Calendar:* **Nika Semkoff Levi-Setti**
*Staff photographer:* **Ron Testa**

**Field Museum of Natural History**
Founded 1893

*President and Director:* **E. Leland Webber**

BOARD OF TRUSTEES

William G. Swartchild, Jr., *chairman*
Mrs. T. Stanton Armour
George R. Baker
Robert O. Bass
Gordon Bent
Harry O. Bercher
Bowen Blair
Stanton R. Cook
O.C. Davis
William R. Dickinson, Jr.
Thomas E. Donnelley II
Marshall Field
Nicholas Galitzine
Paul W. Goodrich
Hugo J. Melvoin
William H. Mitchell
Charles F. Murphy, Jr.
James J. O'Connor
James H. Ransom
Mrs. Joseph E. Rich
John S. Runnells
William L. Searle
Edward Byron Smith
Robert H. Strotz
John W. Sullivan
Edward R. Telling
Mrs. Theodore D. Tieken
E. Leland Webber
Julian B. Wilkins
Blaine J. Yarrington

LIFE TRUSTEES

William McCormick Blair
Joseph N. Field
Clifford C. Gregg
Samuel Insull, Jr.
William V. Kahler
Remick McDowell
J. Roscoe Miller
James L. Palmer
John T. Pirie, Jr.
Donald Richards
John G. Searle
John M. Simpson
J. Howard Wood

*Field Museum of Natural History Bulletin* is published monthly, except combined July/August issue, by Field Museum of Natural History, Roosevelt Road at Lake Shore Drive, Chicago, Il. 60605. Subscriptions: $6 a year; $3 a year for schools. Museum membership includes *Bulletin* subscription. Opinions expressed by authors are their own and do not necessarily reflect the policy of Field Museum. Unsolicited manuscripts are welcome. Postmaster: Please send form 3579 to Field Museum of Natural History, Roosevelt Road at Lake Shore Drive, Chicago, Il. 60605. ISSN: 0015-0703.

CONTENTS

3 **Peru's Golden Treasures**
On view February 16 through May 21
*by Robert A. Feldman, research assistant in anthropology*

4 **Photos on this page** and on pages 5, 8, 9, 20, 24, and 25 are of artifacts seen Feb. 16 through May 21 in Hall 26, comprising part of Peru's Golden Treasures exhibit

6 **Royal Burials of Ancient Peru**
*by Geoffrey W. Conrad*

12 **Field Briefs**

14 **Our Environment**

18 **Edward E. Ayer Film Lecture Series**

19 **Fieldiana: Index to 1977 Titles**

27 **February and March at Field Museum**
Calendar of coming events

COVER

Ancient Peruvian gold pin with stylized bird on monkey's back. The bird's eyes are of turquoise. Moche culture. Height: 15.6 cm. Photo courtesy the American Museum of Natural History. This artifact, with other treasures, is to be seen in Hall 26 Feb. 16 through May 21. See "Peru's Golden Treasures," p. 3. Other ancient Peruvian artifacts are shown on pages 4, 5, 8, 9, 20, 24, and 25.

"Peru's Golden Treasures" has come to the United States under the auspices of the government of Peru. Its appearance in the United States has been organized by the American Museum of Natural History, and the exhibit is supported by a federal indemnity from the Federal Council on the Arts and Humanities. All items in the collection were assembled by Sr. Miguel Mujica Gallo of the Museo Oro del Peru.

*Field Museum volunteers Hermann C. Bowersox and William E. McCarthy assisted in the editorial preparation of this issue.*

# Peru's Golden Treasures

**By Robert A. Feldman**

ON FEBRUARY 16, the special exhibition "Peru's Golden Treasures" will open its doors, presenting more than 220 pieces of ancient Peruvian metalwork from the collection of the Museo Oro del Peru. These will be supplemented by more than 50 pieces from the collections of Field Museum and Peabody Museum, Harvard University.

Through this exhibit we hope to provide a glimpse of life in ancient Peru. It is a small slice, cut chiefly from the world of the nobility, but it does yield an interesting bit of the flavor of the most spectacular native society to be encountered by the Spanish explorers of the 16th century.

"Peru's Golden Treasures" is an unusual exhibit. While the conquistadores found vast quantities of gold in Peru, almost none survives today in its original form. In their frenzied efforts to get gold, the conquerors literally tore apart temples and tombs; when they could find no more already wrought, they forced the Indians to mine more. It is almost a miracle that there are any Peruvian gold artifacts left for us to admire. Indeed, it is only because the artifacts have become more valuable than their metal that modern looters—the ones responsible for uncovering most of the tombs even today—don't melt them down for bullion.

What remains shows the mastery over the medium that Peruvian craftsmen possessed. Most Peruvian metalwork was based on the use of hammered sheets which were bent, cut, soldered, embossed, or otherwise worked into often complex patterns. Elaborate castings were made using the lost-wax method; two or more metals could be cast onto each other, or onto hammered pieces. Alloys low in gold were gilded to look like the pure metal. Gold was contrasted with inlays of turquoise, jet, mother-of-pearl, or red *Spondylus* shell, or used with wood, tropical feathers, or multi-colored paint. Gold, silver, or copper bangles were sewn to clothing; large sheets relieved the mohotony of stone or adobe walls in palaces and shrines.

While metal was used widely, the type depended on the status of the user. Copper and bronze served the commoner, but gold was reserved for the nobility. A copper fishhook or needle saw much actual use, while their golden counterparts' uses were more symbolic, as with the silver shovels often used in modern ground-breaking ceremonies. In a similar way, the golden vessels and beakers in this exhibit could have held *chicha* for a nobleman as he opened a public feast or toasted the mummified remains of his dead ancestors, while the commoners who followed him in drinking used cups of pottery.

The objects in this exhibit are works of beauty, providing a reflection of the artistic conceptions of their makers. Yet these artifacts, however beautiful, come to us lifeless, stripped by the tomb-robbers of whatever they might have told us about the death and life of their ancient owners. How old were these Peruvians when they died, what else did they have with them in the grave, what reflection of their lives could have been found if their tombs had not been plundered? These things we will never know.

SLOWLY, ARCHAEOLOGISTS AND HISTORIANS are sifting through the rubble and records left from the conquest, finding lost fragments that can be pieced together to give a picture of the past. In this issue of the *Bulletin* we present a report by Harvard University anthropologist Geoffrey W. Conrad on the progress of this work, and offer some illumination on the lives and deaths of the ancient Peruvians. The artifacts shown on the cover and on pages 4, 5, 8, 9, 20, 24, and 25 are among the treasures exhibited in hall 26 February 16 through May 21. □

---

*Robert A. Feldman is a research assistant in the Department of Anthropology.*

*Illustrations from* Nueva Coronica Y Buen Gobierno, *by Felipe Guaman Pola de Ayala, published ca. 1615, and showing (1. to r.) Inca emperor Atahualpa receiving Francisco Pizarro, the Spanish conqueror; ceremony inaugurating the growing season; a burial.*

*Bird-shaped vessel. Eyes of turquoise. Height 15.2 Possibly Chimu. Height 15.2 cm.*

*Left and below: ceremonial knives, or* tumi. *Chimu; 27.7 and 33.6 cm, respectively, not to scale.*

*Pair of highly detailed ear ornaments. In center of disc is bird with eyes of turquoise. Moche. Length 28.8 and 28.5 cm. Detail below.*

# Royal Burials of Ancient Peru

By Geoffrey W. Conrad

*Photos courtesy of the author*

Chan Chan, one of the largest archaeological sites in the New World, lies near the mouth of the Moche Valley on the north coast of Peru. Founded at a date that is not entirely certain, Chan Chan flourished from about A.D. 1200 to 1470 as the capital of a prehistoric state known as the Chimu empire, or kingdom of Chimor. At the height of their power, just before their conquest by the expanding Inca empire, the lords of Chan Chan ruled the northernmost 1,000 kilometers of Peru's coastal desert.

Today, five centuries after it was abandoned, the capital of Chimor is still a vast, imposing city. Its ruins sprawl over some 25 square kilometers (roughly 10 square miles). Included among its varied architectural remains are adobe brick compounds, courts, pyramids, and other buildings, along with deep wells, sunken gardens, and the fieldstone bases of the tens of thousands of small rooms that housed the bulk of Chan Chan's population. Despite devastating earthquakes and rare but highly destructive rains, some of the major walls continue to stand nearly 10 meters in height.

At the heart of the city is a civic center covering about 6 square kilometers. This "downtown" area is dominated by 10 huge, high-walled compounds measuring up to several hundred meters on a side. Inside each great enclosure are courtyards, rows of storerooms, administrative facilities, wells, and other constructions. These internal subdivisions are connected by labyrinthine passageways that would have made it virtually impossible for anyone who did not belong in the compound to find his way about.

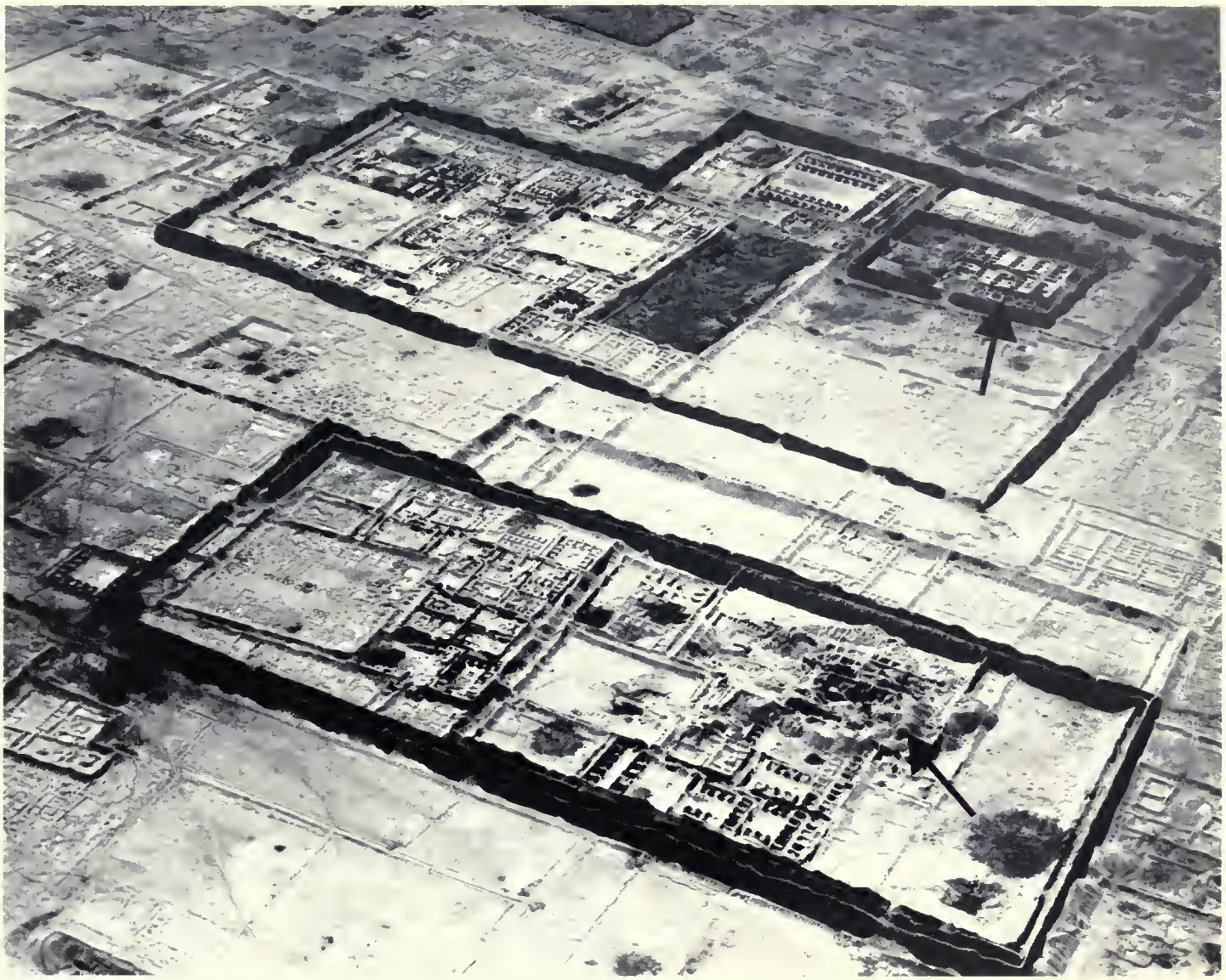
In 9 of the 10 compounds the largest single structure is a platform-shaped mound with steeply sloping sides and multiple internal chambers, or cells. At first glance, the most striking aspect of these mounds is the damage wrought upon them by generations of looters. A few platforms are relatively well preserved, but most look as if they had been directly hit by a stick of bombs.

From mid-1970 through mid-1972 my co-workers and I spent a total of 14 months studying these platforms—surveying all of them, intensively excavating one, and testing the others. Before these investigations Andean archaeologists had not realized that the platforms should be grouped together as one type of building. Instead, individual platforms had been identified as everything from harems to granaries to prisons. However, our work showed that all of the mounds were actually extremely prestigious funeral places, and we dubbed them "burial platforms." In the course of our work we also came to realize that these structures embodied important, but intangible, aspects of Chimu culture: principles of social structure, political organization, law, and religious belief.

Our research showed that despite differences in detail, the burial platforms shared certain basic characteristics. Each is a truncated pyramidal mound containing multiple cells that must be entered from above. Access to the top of the platform, thence to the internal chambers, is via a ramp or system of ramps along the north face of the mound. Entrance to the ramp system is restricted and controlled by a forecourt built adjacent to the north side of the mound. All of these construc-

---

*Geoffrey W. Conrad is assistant professor of anthropology at Harvard University.*



*Aerial view of part of the civic center of Chan Chan. Two of the city's great compounds ("palaces") lie in the foreground. Arrows indicate the burial platforms inside these buildings. The total extent of Chan Chan was about 10 square miles.*

tions are surrounded by an enclosure wall that separates the burial platform complex from its surroundings.

Wherever the arrangement of the cells in a platform is still apparent, it follows a standard pattern. The central location is occupied by a large chamber shaped like the letter T, with the cross to the north. Around this principal chamber are smaller, rectangular, secondary cells. We believe that all of the platforms originally followed this pattern, an idea supported by an unusual source of archaeological information—the distribution of the destruction caused by looters. Even in the most heavily damaged mounds the best preserved sections are the peripheries, which consistently contain only secondary cells. The destruction is always greatest in the center of a platform, exactly where its principal T-shaped cell should have been.

Another architectural characteristic of the burial platforms is the presence of structural additions erected after the construction of the original mound. These additions are of two types, primary-stage and secondary-stage.

Nearly all of the burial platforms have a primary-stage addition, which invariably takes the form of a U-shaped ring surrounding the original mound on all but the north side. Primary-stage additions contain only rectangular secondary cells.

Many of the platforms also have a secondary-stage addition. These latter structures vary in detail, but they always appear as miniature burial platforms built near or adjacent to the original mound. The cells in secondary-stage additions are more elaborate than the rectangular chambers of the primary-stage additions.

*"Tweezer" pendant. A gold ring supports "tweezers" in lunate form. Moche, height 10.8 cm.*

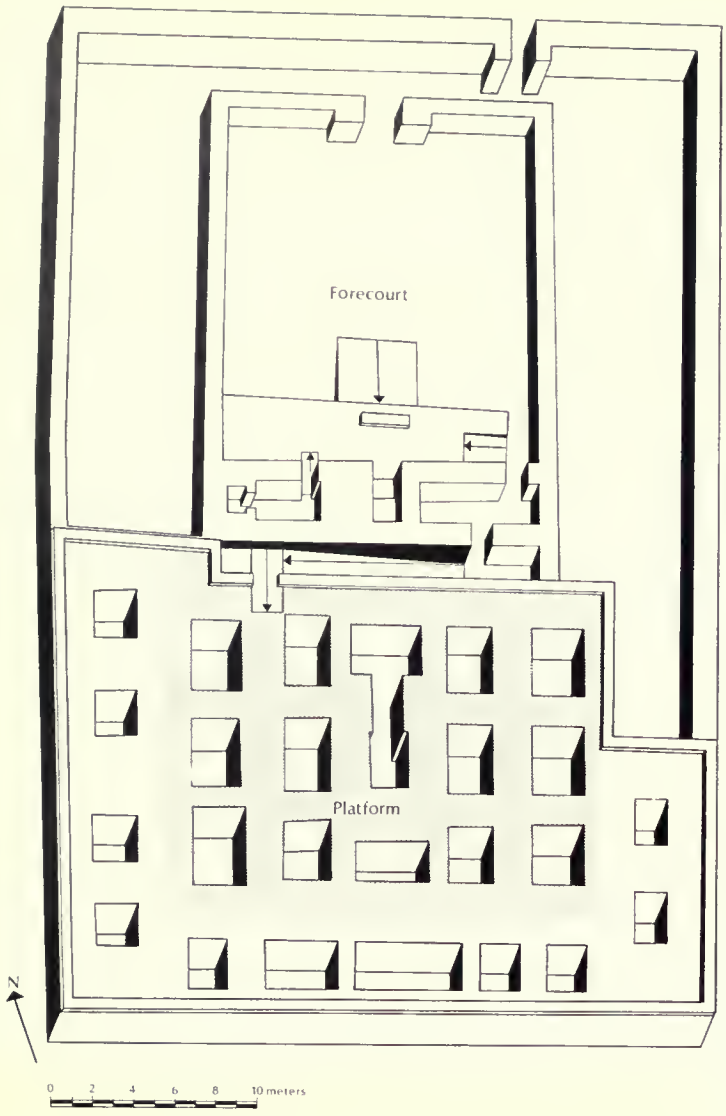
*Stylized puma of hammered sheet gold. Moche. Length 64 cm.*

*Stylized bat. Gold sheet with traces of red paint. Nazca. Width 31 cm.*

## *Peruvian Tour for Members*
## May 16-30

MODERN LIMA, Indian Cuzco, colonial Trujillo, and fabulous Machu Picchu are just some of the colorful highlights of a 15-day tour of Peru exclusively for Field Museum Members. The departure date from Chicago is May 16; the group returns May 30. In addition to the many archaeological and tourists' attractions on the itinerary are a good number of sites rarely visited by the conventional tour. Deluxe hotel accommodations have also been reserved. Dr. Michael Moseley, Field Museum associate curator, whose specialty is Middle and South American archaeology and ethnology, will lead the group. He has done extensive excavation work at sites to be visited.

TOTAL COST of the tour, which includes a $250.00 tax-deductible contribution, is $2,195.00. For further information, write to Dorothy Roder, Membership Secretary, Field Museum, Roosevelt Road at Lake Shore Drive, Chicago, Illinois 60605, or call her at 922-9546.




*Reconstruction of the excavated burial platform. The gray area is the original platform; note the principal T-shaped chamber in the center and the surrounding rectangular secondary cells. Surrounding the gray area, below and to the sides, is the platform's primary-stage addition, a U-shaped ring containing only secondary cells.*

In fact, in several platform complexes it is clear that the secondary-stage addition contains smaller replicas of the principal T-shaped chamber of the main mound.

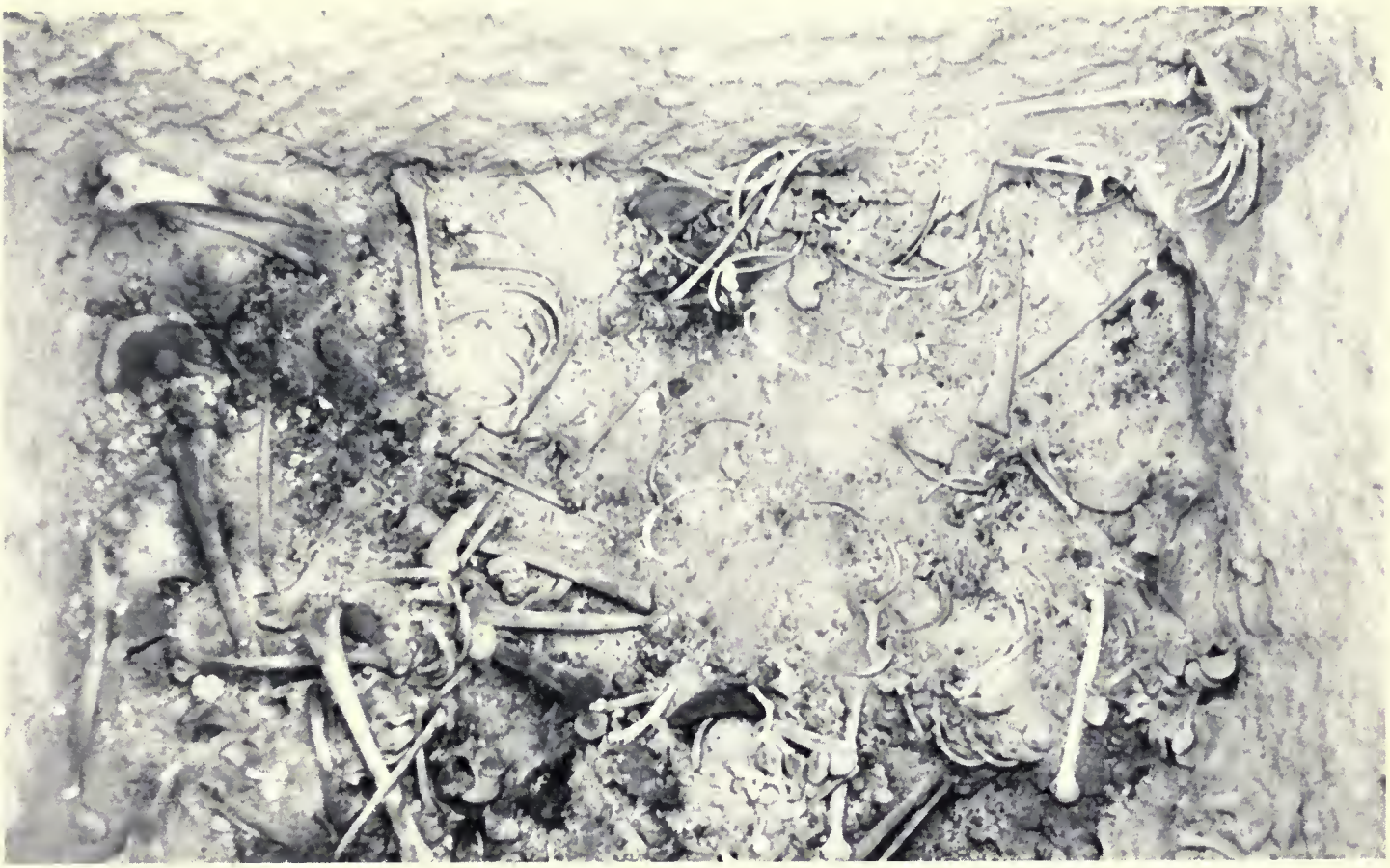
The contents of the burial platforms are as specialized as their architecture. First, as their very name implies, the mounds hold large numbers of human bones. Only one platform—one of the smallest—was intensively excavated, and even then no more than a quarter of the backdirt filling its 25 chambers was removed. Nonetheless, traces of at least 93 burials were recovered. Only one cell was fully cleared; it held 13 complete skeletons stacked like cordwood, along with the partial remains of at least 11 more bodies. (It took me three full days to map and remove all this skeletal material, and the memory is still vivid. I spent the whole time squatting like a baseball catcher, unable to move my feet for fear of breaking the bones of a dead Chimu.) It seems safe to say that this platform originally held several hundred individuals. Intriguingly, all of the bones that could be diagnosed were those of adolescent girls and young women.

Second, the platforms contain the greatest concentrations of prestigious objects in Chan Chan. Fragments of fine pottery, fancy textiles, carved wood, weaving equipment, and copper metalwork were all encountered in quantity. Another abundant item was the bright red shell of *Spondylus,* a marine mollusk native to warm coastal waters north of Peru. Both whole shells and a pink powder produced by crushing and grinding them were found. Prehistoric peoples of coastal Ecuador, where *Spondylus* is common, used the mollusk simply as a source of food, but in Peru its shells were imported status symbols.

Conspicuously absent from this list of highly valued artifacts is metalwork in silver and gold, a condition which is not surprising. While modern looters ransack the ruined platforms in search of fine pottery for the illegal antiquities market, gold and silver were the goals of the treasure-hunters who first plundered the platforms more than 400 years ago. In fact, a document discovered in an archive in the nearby city of Trujillo indicates that during the Spanish Colonial era the burial platforms were treated for legal purposes as gold and silver mines. The mounds were exploited under the laws governing mining operations, with the Spanish crown taking its "royal fifth" of the booty. In short, the platforms must have once contained huge quantities of gold and silver objects similar to the Chimu artifacts in Field Museum's exhibition *Peru's Golden Treasures,* opening February 15.

Finally, our investigations revealed two more crucial facts about the burial platforms. First, they were the most opulent and prestigious funeral places in the Chimu empire. Second, the platforms (and the great compounds that house them) were built one at a time. These facts, along with the information discussed above and several other lines of evidence, lead to one conclusion: the burial platforms were the tombs of the kings of Chimor.

Our data support the following reconstruction of the use of a Chan Chan burial platform. Each of these structures was built by one of the kings of Chimor, whose death set in motion a series of elaborate funeral ceremonies extending over a considerable period of time. After careful preparation the dead king's body was placed in the principal T-shaped chamber of his burial



COURTESY PEABODY MUSEUM, HARVARD UNIVERSITY

*Assorted bones in one of the secondary cells of the excavated platform. This small chamber contained 13 complete skeletons. It may once have held 24 bodies; 24 right calcanei (heel bones) were found among its contents.*

platform. Great quantities of offertory goods were installed with him and in some or all of the secondary cells.

Ritual human sacrifice must also have been an important part of Chimor's royal funeral rites. Such a practice is the most satisfactory explanation for the fact that all of the diagnostic bones from the excavated burial platform were those of adolescent girls and young women. These bones are probably the remains of young women—servants and subsidiary wives—who were ceremonially killed and then placed in some or all of the platform's cells to accompany the king and stress his importance.

Large numbers of llamas were also sacrificed during the ceremonies. However, to judge from the available information, these animals were not placed in the platform's cells. Instead, they were interred beneath the floor of the burial platform complex, just inside the enclosing wall.

Some time passed after the completion of this first phase of the mortuary rites; I suspect, but cannot prove, that the interval was fixed by law. After this time had elapsed, the dead king was commemorated by repeating aspects of his funeral ceremony. A primary-stage structural addition—a U-shaped block containing further secondary cells—was erected around three sides of the king's burial platform. The new secondary cells in the addition were then stacked with further offertory goods and human sacrifices.

Secondary-stage additions also contained burials and offerings, but they were not equivalent to their primary-stage counterparts. Instead, the elaborate nature of the former shows that they held persons of high social position. While those individuals were obviously not the equals of the dead king, the fact that some of them were interred in smaller replicas of the ruler's T-shaped burial chamber argues that they were closely affiliated with him. I suggest that the secondary-stage addition to a burial platform was a funeral place reserved for important relatives and descendants of the deceased king.

Perhaps the most significant aspect of the pattern described above is that, after an initial period of experimentation and variability, it became rigidified and was repeated by every king of Chimor. That is, each Chimu ruler built his own burial platform. The importance of this phenomenon lies in the fact that it had parallels in the Inca empire which were reported by the early Spanish chroniclers. Although their written records deal primari-

*(Continued on p. 21)*

# FIELD BRIEFS

### What's in a Name?

Animal hybrids generally look like perfectly reasonable, functional creatures, though their parents may view them with curiosity, suspicion, or even alarm. Their genes, too, may be in a state of discontent, for a good many such crosses are sterile, no matter how vigorously the animals may attempt to emulate the fecundity of their forebears.

Ken Grabowski, Field Museum library assistant, has noted that while hybrids often do not bear young, they frequently do bear names that have a certain felicitous ring to them, suggesting that Lewis Carroll, James Joyce, or even Doctor Seuss may have had something to do with their naming. Grabowski's research into the matter has yielded a collection of such names, including those on the list below. Attentive readers will note that the parents are sometimes subspecies within the same species, more commonly different species within the same genus, and occasionally species of different genera.

**asbra**: offspring of male donkey (*Equus asinus*) and female zebra (*E. burchelli*)
**carideer**: male caribou (*Rangifer tarandus caribou*) with female reindeer (*R. tarandus*)
**cattalo**: male domestic bovine (*Bos taurus*) with female bison (*Bison bison*)
**coydog**: male domestic dog (*Canis familiaris*) with female coyote (*C. latrans*)
**hinny**: male horse (*Equus caballus*) with female ass (*E. asinus*)
**huarizo**: male llama (*Lama glama*) with female alpaca (*L. pacos*)
**leopon**: male leopard (*Panthera pardus*) with female lion (*P. leo*)
**liger**: male lion (*Panthera leo*) with female tiger (*P. tigris*)
**llamahuanaco**: male guanaco (*Lama guanicoe*) with female llama (*L. glama*)
**llamavicuña**: male vicuña (*Vicugna vicugna*) with female llama (*Lama glama*)
**machurga**: male alpaca (*Lama pacos*) with female llama (*L. glama*)
**misti**: male alpaca (*Lama pacos*) with female llama (*L. glama*)
**mule**: male ass (*Equus asinus*) with female horse (*E. caballus*)
**onza**: male jaguar (*Panthera onca*) with female cougar (*Felis concolor*)
**ovid**: male goat (*Capra hircus*) with female sheep (*Ovis aries*)
**pacovicuña**: male vicuña (*Vicugna vicugna*) with female alpaca (*Lama pacos*)
**podiac bear**: male polar bear (*Thalarctos maritimus*) with female Kodiak bear (*Ursus arctos middendorffi*)
**tigon**: male tiger (*Panthera tigris*) with female lion (*P. leo*)
**yakalo**: male yak (*Bos grunniens*) with female bison (*Bison bison*)
**zebroid**: male zebra (*Equus burchelli*) with female horse (*E. caballus*)

### Museum Operations Conference March 29-31

Commercial activities of museums, the ethical and legal implications of curator and trustee collecting, the new copyright law, and new federal regulations concerning handicapped museum visitors and job applicants, will be among the topics discussed at the sixth annual Conference on Legal Aspects of Museum Operations, to be held at Field Museum March 29-31. The conference is cosponsored by the Smithsonian Institution and the American Law Institute-American Bar Association's Committee on Continuing Professional Education.

Legal Aspects of Museum Operations will provide museum administrators, museum counselors, and other lawyers with up-to-date, practical information on legal problems confronting museums.

The registration fee for the three-day conference is $225, which includes all sessions, study outlines and related materials, three luncheons, and a reception. Overnight accommodations have been reserved at hotels within walking distance of the Museum.

For further information write: Legal Aspects of Museum Operations, ALI-ABA Committees; 4025 Chestnut Street; Philadelphia, PA 19104.

It is anticipated that scholarships for partial support of tuition and travel expenses will be available for those who cannot attend without financial aid. Persons interested in applying for such assistance should submit a statement justifying their request and a personal resume to Museum Scholarship Committee, c/o the ALI-ABA Committee.

### Bushman Bust Located

The mystery of Bushman, Field Museum's celebrated gorilla, has been solved. The September 1977 *Bulletin* carried a feature article on Bushman, with an accompanying photo (p. 9) of a "bronze" bust of the gorilla. The photo caption read "The identity of the sculptor (the man in the photo?) and the present location of the fine bust are a mystery."

Subsequently, Field Museum members John Moyer and Norman H. Gerlach individually wrote to clear up most of the questions. The present location of the bust, they point out, is the library of Chicago's Adventurer's Club (310 S. Michigan Avenue), where it has been for a number of years. It is made of plaster, not bronze, and was completed in 1947. Moyer and Gerlach, both members of the Adventurer's Club, also identify the sculptor as C. J. Albrecht, Field Museum's taxidermist from 1926 to 1945. Albrecht retired many years ago and is believed to reside today in Clitherall, Minnesota. The man in the photo remains unidentified.

### James H. Quinn

James Harrison Quinn, former chief geology preparator at Field Museum, died September 14 at the age of 71. He

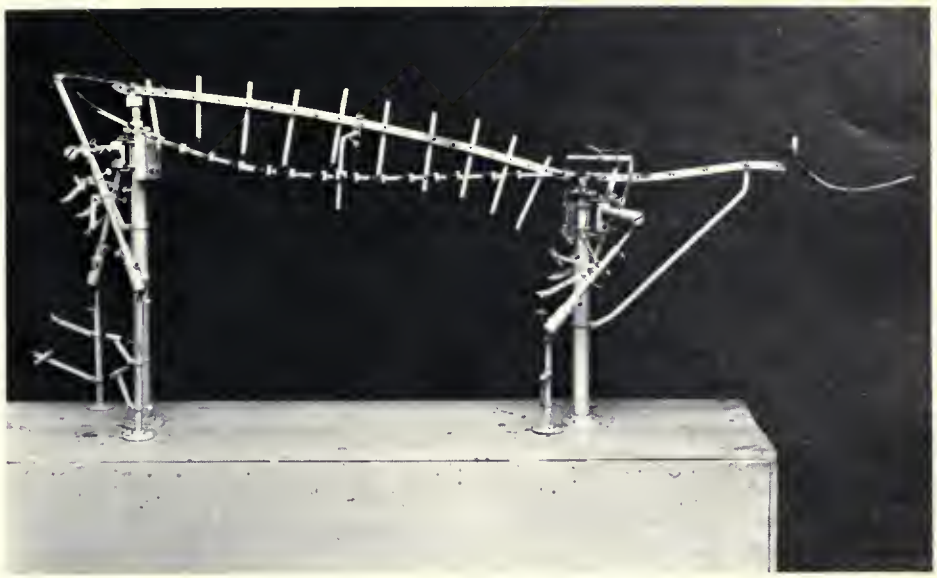
was killed in a rock fall while fossil-collecting on the Snake River, in northwestern Nebraska. Born in Ainsworth, Nebraska, in 1906, Quinn came to Field Museum in 1930 at the age of 24 and left in 1947. His 17-year tenure at Field Museum was notable for his preparation of hundreds of fossil specimens and for two remarkable preparation technique which he innovated.

Quinn's secondary school education was delayed, but he managed by the age of 24 to secure his high school diploma, graduating as valedictorian. At 41, after leaving Field Museum, he began work toward his bachelor's degree at the University of Arizona where, in due course, he earned his B.Sc. Subsequently he received his Ph.D. in geology at the University of Texas. For the next 19 years—until his retirement—Quinn was on the faculty of the University of Arkansas, where he taught geomorphology and paleontology. His bibliography includes 55 papers, the final one appearing in Field Museum's continuing monograph series *Fieldiana: Geology:* "Sedimentary Processes in *Rayonoceras* Burial" (1977).

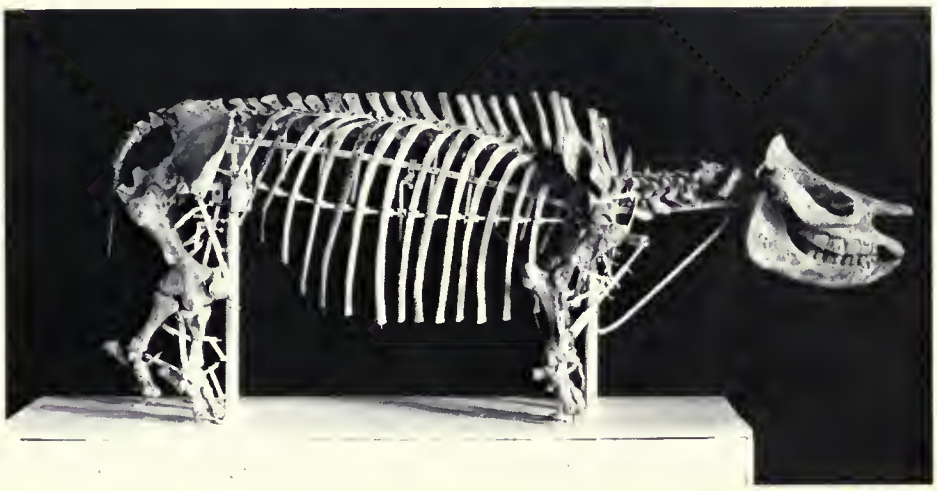
His best known preparation technique was a method (long used but now superseded) of making plaster casts of fossils with latex as the molding medium. Quinn also devised the remarkable "Quinn skeleton mounter," a familiar sight in the geology preparator's lab for many years. This consisted of ball-and-socket joints from steering columns, jacks, universal joints, and other automobile parts. Together, these provided an adjustable temporary support while a large skeleton was being posed, until permanent supporting irons could be formed and placed. Prior to Quinn's invention, a great clutter of miscellaneous support props would usually accumulate around a specimen being mounted, and every adjustment in pose would require a laborious disassembly and reconstruction of the unwieldy temporary supports.

A fine example of Quinn's work is shown here, with three stages of the reconstruction of *Teleoceras fossiger,* an aquatic rhinoceros that occurred in North America about 10 million years ago. Quinn's reconstruction may be seen today in Hall 38.

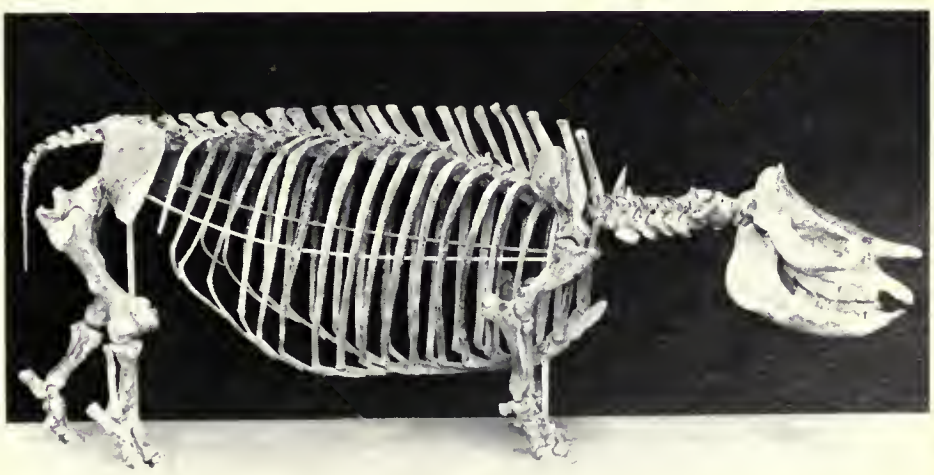
— *William Turnbull,*
*curator of fossil mammals*



"Quinn's skeleton mounter," an adjustable metal frame consisting of automobile parts.



*Teleoceras fossiger* with Quinn's device supporting the skeleton.



The complete *Teleoceras* skeleton with permanent irons in place of the temporary adjustable supports.

# OUR ENVIRONMENT

### Bye-Bye Birdwing

Trading in butterflies is big business. Big enough for one country, Taiwan, to earn £12 million a year from exports. Big enough for wealthy collectors to pay up to £750 for single specimens.

Last year even the business columns of London newspapers were urging stock marketeers to buy rare butterflies as a hedge against inflation. It was an unfortunate tip, to say the least. For the most sought-after species, the birdwing family, are now in danger of being hounded to extinction. The biggest butterfly of all, Queen Alexandra's birdwing, is found only in a few remote localities in Papua New Guinea. Yet even here, in some of the most inaccessible places left on earth, it has become an endangered species.

With its eleven-inch wingspan and purposeful, batlike flight, the Queen Alexandra's birdwing is so big that the first specimens captured were brought down from treetop height by shotgun. Less drastic but far more effective methods are used to catch it now that hunters have discovered its fatal weakness—a fondness for urine.

To make matters worse, the mountain rain-forest haunts of the great birdwings, in Papua New Guinea, the Moluccas and the Solomon Islands, are being destroyed by logging and mining companies—a threat which most conservationists regard as infinitely more serious than the collectors.

When the danger became clear, the government of Papua New Guinea banned the collection of all but two species of birdwing. And yet illegal trafficking continues. Government officials estimate that £70,000 worth of protected birdwings are on sale in Britain and Germany alone. At least two European collectors have been fined and deported from New Guinea in the last 18 months.

Nevertheless, half a dozen illegal birdwing collectors—three Japanese and three Europeans, one of whom poses as as a representative of the British Museum of Natural History—are still operating there.

The butterflies reach the outside world via Australia, where they are smuggled aboard international flights for London, Tokyo, and the United States.

One of the liveliest markets for butterflies is Japan, where firms like the Insect Educational Centre, run by the New Science Publishing Company, sell rare birdwings for up to £45 each. Another Japanese dealer, Mr. Seiji Sakai, of Tokyo, has been privately offering fresh papered specimens of Rothschild's birdwing, a protected species from West Irian, for $850 a pair.

It was also the Japanese, a century ago, who introduced butterfly collecting to Taiwan—now the world leader in butterfly exploitation, where trading has reached industrial proportions and production lines of up to 50 women toil for 14 hours a day. Butterflies are heaped on tables in piles of 10,000 or so. The woman carefully tear off the wings and paste them to simulated paper bodies which are then pressed between laminated vinyl sheets to be turned into book markers, coasters, or table mats.

Although Britain can hardly compete with Taiwan, the trade here is brisk enough to sustain several dealers and butterfly farms, some of whom produce lavish catalogs to advertise their wares. These range from single "papered" (*i.e.,* unmounted) specimens for serious collectors to whole groups of exotic species, speared on pins in gilt-framed display cases or set in ornamental gift boxes.

It is this growing fad for insects as home decor that is really alarming the conservationists. Nowaways butterflies are being sold in seaside gift shops, high street stores and even supermarkets. Butterfly jewellery made from the iridescent blue wings of South American *Morpho* butterflies is a popular novelty.

The biggest breeder and dealer in England is probably Robert Goodden, director of Worldwide Butterflies, whose three-acre butterfly farm near Yeovil has a home-grown jungle under glass for visitors to watch tropical butterflies on the wing.

Goodden, who sells everything from a 90-pence pack of caterpillars to exotic dead butterflies at £33 each, stoutly defends his trade. "We have increased interest in butterflies in this country more than anyone," he says. "Nor do I disapprove of children chasing butterflies with a net. That is how people become interested."

But Goodden himself believes the time will come when collecting has to stop.

In 1974 he was largely responsible for setting up the Entomological Suppliers Association, to which most leading British dealers now belong. The ESA has its own voluntary conservation code and has drawn up a "red list" of endangered species which members promise not to buy or sell. Since last year this has included all the protected birdwings.

Unfortunately not all British dealers are bound by the ESA code. Nor is it illegal for these butterflies to be sold in Britain. As a result, protected species from Papua New Guinea are still being offered by some British dealers for anything up to £200 a pair.

But whatever the state of the market in Britain, butterfly-collecting has become a big-money sport on the Continent, with collectors' clubs, poaching gangs and a fortnightly catalogue of prices—the *Insektenborse*—published by the specialist West German magazine *Entomologische Zeitschrift.*

In France, the activities of Europe's avaricious collector-dealer complex are causing heartache in the Hautes Alpes. About 10 years ago the *Insektenborse* reported that a valley near Digne contained several unique species of butterflies. The result was that over the next few years the locality became a venue for hunters from all over the world.

The valley was a haven for one species in particular, the Glory of the Gauls. It was discovered only 30 years ago near the village of L'Argentière-la-Bessée. It is now almost extinct.

Laments Dr. Guy Droit, a leading protectionist who lives nearby: "What we are witnessing is the total destruction of a fragile and beautiful form of life. When it has gone we shall all be poorer." — *Brian Jackman, from the* London Times.

### Habitat Rating System

Habitat suitability, while certainly one of the most important parameters in any wildlife management plan, is also one of the most difficult to quantify. Traditionally, wildlife managers have relied on the expertise of an independent authority in assessing the potential of a given land area to support a particular species. Although in many instances such an individualized analysis has been adequate, the possibility of applying such a system on a broad scale has severe limitations. In many respects, habitat evaluation has been a personalized art rather than a science.

Biologists with the Missouri Department of Conservation, reports *Conservation News*, are working to change this, however. After more than three years of intensive study, Jack Stanford, a quail biologist with the department, believes he has perfected a system which will enable managers to evaluate habitat suitability for nearly any species on an objective, numerical basis.

Under Stanford's Numerical Rating of Parameters system, a given plot of land is analysed according to the frequency of vegetative encounters. The basic tool of the evaluation is aerial photography. From an aerial census, a straight line is plotted. Along the transect line vegetative encounters are broken down into three critical components: diversity—the number of changes in vegetative types that are found; composition—the actual makeup of these vegetative types; and, interspersion—the mix of these types. Then, based on the biological requirements of a particular species, the observations are given a numerical value on a scale of 2 to 12 based on how well they satisfy the needs of that species.

For example, cornfields are important feeding areas for quail. Yet without the protective cover of nearby woodlots of extensive fencerows, their value as quail habitat is only minimal. Thus, a grainfield next to a barren pasture might score only a two, while a cornfield bordered by a shrubby fencerow might score as high as 10 or 12. Stanford emphasizes that diversity, composition, and interspersion are integrated to formulate the overall assessment. He notes that none can stand alone in the context of the evaluation.

### Lead Poisoning in Waterfowl

Every year around 20 million waterfowl die during migration—from Canada to wintering grounds and back to breeding grounds in Canada—from various causes that do not include kills by hunting. Included in this mortality, though, are 1.6 - 2.4 million birds that die of lead poisoning.

Milton Friend, director of the National Wildlife Health Laboratory, in Madison, Wisconsin, reports that lead poisoning may be the most common disease in waterfowl across the country. The man-made disease erupts after waterfowl ingest spent lead shot—deposited at the rate of 3,000 tons annually—which breaks down to lead salts in the bird's body and enters the bloodstream with lethal effects.

The FWS laboratory regularly samples specimens picked up throughout the United States. "Regardless of where we get the specimens from, a representative number of those dead birds will be positive for lead poisoning," says Friend. Findings at the laboratory disclosed a high prevalence of lead in samples from California to Massachusetts, and from South Dakota to Texas.

Lead poisoning is primarily a disease that occurs after the hunting season. The major source of lead shot in birds is the annual deposition put down from hunting. During the hunting season, the pressure of human activity keeps the birds moving, thus prohibiting normal bird use of areas being hunted.

Following the season, the birds ordinarily resume natural feeding habits which involve a greater use of hunted areas. At this time they are exposed to lead shot at a much higher rate, Friend said. A case in point: the die-off of approximately 4,000 Canada geese last winter in southern Illinois. The birds took on nourishment in winter wheat fields. "That's where the goose blinds were; that's where the shooting occurred and the lead was deposited; that's where feed was available," Friend declares.

Another aspect that has not come to full light in assessing the disease is that it doesn't stop, necessarily, with the bird that dies of lead poisoning. the FWS now has several cases on record to confirm secondary lead poisoning in bald eagles. Levels of lead in these eagles have conclusively shown they died of secondary lead poisoning.

### Administration Would Protect 92 Million Alaskan Acres

The Carter Administration's proposal to give special attention to 92 million of Alaska's 375 million acres has been presented to Congress. The Recommendations were made under the Alaska Native Claims Settlement Act.

The administration's recommendations would add approximately 45.1 million acres to the National Wildlife Refuge System and 41.7 million acres to the National Park System, more than doubling the size of both systems. The proposal also would include 33 rivers and river segments in the National Wild and Scenic Rivers System totaling some 2.5 million acres. It would add about 2.5 million acres to existing national forests in Alaska.

The plan would establish 10 new units of the National Park System while expanding three existing parks. The U.S. Fish and Wildlife Service would acquire nine new refuges and expand five others. The national forest additions would be to the Chugach and Tongass National Forests in south central and southeastern Alaska.

An earlier draft of the administrtion's proposal recommended that Admiralty Island, now a part of the Tongass National Forest, be given to the Park Service for a "National Preserve." The final version, however, suggested that the island remain in the forest and be designated official wilderness.

Largest of the national park proposals is the Wrangell-St. Elias, a wild area of 18,000 square miles in southeastern Alaska adjoining Canada's Kluane National Park. It contains the nation's greatest collection of peaks over 16,000 feet, including Mount St. Elias, at 18,008 feet the second highest in North America.

Further north is the existing Mount McKinley National Park, established in 1917 and containing North America's highest peak, Mount McKinley at 20,320 feet. The park would be enlarged to 5.7 million acres and renamed Denali, the Alaska Indian name for the great peak.

# *Peru's Golden Treasures Lecture Series*

A special lecture series in March brings well known experts in the field of South American ethnology and archaeology to lecture on aspects of ancient Peruvian culture and history. Series and single tickets are available. Please use the coupon below (or facsimile).

Before each lecture, at 6:00 p.m., a special dinner will be available to members. This meal is by reservation only; the price is $7.00. The reservation form below (or facsimile) may be used. Members may make reservations for the lecture series and dinners for their guests. Limited to 400 reservations. All lectures are at 8:00 p.m., Friday evenings, in James Simpson Theatre, west door entrance.

**March 3**

*Treasures Lost: The Gold of the Inca.* Lecturer is Craig Morris, assistant curator of South American archaeology, American Museum of Natural History.

Few pieces of gold from the Inca period survived Spanish greed which turned most of their priceless objects into ingots. Fortunately, sixteenth century eyewitnesses to the capture of the Inca empire wrote down much of what they noted about the use of gold in the last few days of the native state. In addition to intriguing descriptions of the objects we get glimpses of the uses of gold — as personal adornment, as a symbol of the sun god, and as a material used to make replicas of plants, animals, and temple gardens. Dr. Morris's lecture concentrates on the unusual role of gold in Inca society.

**March 10**

*Chan Chan, The Andean Desert Empire.* Lecturer is Michael Moseley, associate curator of Middle and South American archaeology and ethnology, Field Museum.

On the north Coast of Peru, the Chimu empire stretched along the Pacific shoreline from Ecuador to Lima. The Chimu imperial capital was the vast city of Chan Chan, the ruins of which extend over more than ten square kilometers of desert. This illustrated lecture focuses on Chan Chan and Chimu society. It will draw upon the latest research results of Field Museum's archeological expedition, which is currently exploring the sprawling ruins and the foundations of the Chimu economy.

*Above and at right: portions of adobe friezes found at ancient Peruvian city of Chan Chan*

**March 17**

*The Moche: Ancient Peru's Mastercraftsmen.* Lecturer is Christopher Donnan, director of the Museum of Cultural History, Los Angeles.

More than 1,000 years before the beginning of the Inca empire, a people we now call *Moche* flourished on the coastal plain of northern Peru. Although the Moche had no writing system, they produced a vivid artistic record of their activities and their environment in beautifully modeled and painted ceramics, elaborately woven textiles, and exquisitely crafted objects of copper, silver, and gold. This lecture focuses on the technology as well as the iconographic meaning of Moche art.

## *Peru's Golden Treasures Lecture Series*

### Reservations

Please make the following reservations in my name:

_____ members' tickets ($7.00 ea.) for lecture series
(quantity)

_____ nonmembers' tickets ($10.00 ea.) for lecture series

_____ members' tickets ($2.50 ea.) for March 3 lecture

_____ nonmembers' tickets ($3.50 ea.) for March 3 lecture

_____ members' tickets ($2.50 ea.) for March 10 lecture

_____ nonmembers' tickets ($3.50 ea.) for March 10 lecture

_____ members' tickets ($2.50 ea.) for March 17 lecture

_____ nonmembers' tickets ($3.50 ea.) for March 17 lecture

_____ members' tickets for March 3 dinner, $7.00 ea.

_____ members' tickets for March 10 dinner, $7.00 ea.

_____ members' tickets for March 17 dinner, $7.00 ea.

Enclosed is my check for $_____

Name _____

Address _____
street city state zip

Mail this reservation form (or facsimile) to: Peru's Golden Treasures Lecture Series, Field Museum, Roosevelt Road at Lake Shore Drive, Chicago, Il. 60605

# Edward E. Ayer Film Lecture Series

## March and April

*Saturdays, 2:30 p.m.*
*James Simpson Theatre*

The new ground-level west door entrance provides free admission to James Simpson Theatre. However, access to other museum areas requires the regular fee or membership identification. These illustrated lectures are approximately 90 minutes long, and are recommended for adults. Doors open at 1:45 p.m.; a limited section of reserved seats is available for members and families on days of the lectures until 2:25 p.m.

---

**March 4**
*Treasures of Italy*
by Kenneth Richter

Join the tour at dawn on majestic Mt. Etna, continue down through the countryside to the Greek theatre in Taormina. Visit archaeology students searching for evidence of the mysterious Etruscans; view Roman architecture, medieval pageantry, and the landmarks of Florence that echo the birth of the Renaissance.

**March 11**
*India*
by Jens Bjerre

Known as the "golden tour," this journey includes Delhi, one of the oldest capital cities in the world, famous for the Gate of India, the Taj Mahal and 13th century architecture. Calcutta, another face of India, teems with a populace of 10 million. The film-maker intertwines lifestyles of city and country people in daily life and sacred ritual.

**March 18**
*Mediterranean—East to Istanbul*
by Fred Bellinger

A rare opportunity to discover beautiful palaces on the Mediterranean coast. From historic cities to the picturesque countryside, each camera view is a story of the land and people.

**March 25**
*The Soul of Japan*
by Ken Wolfgang

The beauty of the Orient and its people is captured in this superb photographic study. Three years of research and film-making produced this remarkable profile of Japan.

**April 1**
*Iran*
by Chris Borden

Shrines of mystics and dervishes adorn the countryside. Lush tea plantations and rice fields border the Caspian Sea in the north; to the south and east hot dry deserts are peopled by nomads. Included on this trip are Teheran, famous and modern; Hamadon, the oldest; Mashhad, the holy city; and Isfahan, the "city of mosques."

**April 8**
*Great Sailing Adventures*
by Captain Irving Johnson

Loaded to her lines with 5300 tons of cargo, the "Peking" encounters furious storms of the dreaded Cape Horn. This film, held in the archives of the British Museum, is accompanied by another film record, the voyage of the Brigantine "Yankee," which includes spectacular footage of the Sepik River.

**April 15**
*Fabulous Rio - Portraits of Brazil*
by Curtis Nagle

A memorable view of a growing, changing country. See the world-famous carnival in Rio; ultramodern industrial Sao Paulo; colonial Salvador and Ouro Preto; the flora and fauna of the Amazon river; and enjoy a holiday with the gauchos.

**April 22**
*To Spot a Zebra*
by Quentin Keynes

Join the film-maker on an expedition to Africa to find the only known spotted zebra. Keynes, great-grandson of Charles Darwin, takes us to South Africa, Botswana, Rhodesia, Zambia and a remote corner of Tanzania during his search.

**April 29**
Mexico-Legend of a Lost Crown
by Howard and Lucia Meyers

Film and drama are combined to bring a new dimension to photographic presentations. The splendor of Europe's great palaces and museums is brought together with the story of Maximilian and Carlota on their last mission to Mexico.

# Fieldiana: 1977 Titles

FIELDIANA is a continuing series of scientific papers and monographs in the disciplines of anthropology, botany, zoology, and geology; the series is intended primarily for exchange-distribution to museums, libraries, and universities, but all titles are also available for public purchase.

The following titles were published during 1977 and may be ordered from the Division of Publications. Members are entitled to a 10 percent discount. Publication number should accompany order. A catalog of all available *Fieldiana* titles is available on request. (Please specify discipline: anthropology, botany, geology, or zoology.)

**Fieldiana Anthropology**

"Human Biogeography in the Solomon Islands," by John Terrell. Vol. 68, No. 1; publication 1257. $2.00

"A.F. Kashevarov's Coastal Explorations in Northwest Alaska, 1838," edited by James W. VanStone, translated by David H. Kraus. Vol. 69; publication 1268. $4.00

**Fieldiana Botany**

"Ferns and Fern Allies of Guatemala Part I Ophioglossaceae through Cyatheaceae," by Robert G. Stolze. Vol. 39; publication 1246. (Pub. Dec. 1976.) $4.75

"Preliminary Taxonomic Studies in the Palm Genus *Attalea* H.B.K.," by S. F. Glassman. Vol. 38, No. 5; publication 1250. $1.25

"Revision of *Oparanthus* (Compositae, Heliantheae, Coreopsidinae)," by Tod F. Stuessy. Vol. 38, No. 6; publication 1251. $.75

"Comprehensive Index to the Flora of Guatemala," by Terua P. Williams. Vol. 24, Part XIII; publication 1260. $8.50

"Austral Hepaticae IX *Anastrophyllum tristanianum*, A New Species from Tristan da Cunha," by John J. Engel. Vol. 38, No. 7; publication 1267. $.75

"Flora Costaricensis," edited by William Burger. Vol. 40; publication 1270. Price to be announced.

**Fieldiana Geology**

"*Megapleuron zangerli* A New Dipnoan from the Pennsylvanian, Illinois," by Hans-Peter Schultze. Vol. 33, No. 21; publication 1248. $1.25

"A Primitive Pyrothere (Mammalia, Notoungulata) From the Early Tertiary of Northwestern Venezuela," by Bryan Patterson. Vol. 33, No. 22; publication 1249. $1.25

"The Stature and Weight of Sterkfontein 14, a Gracile Australopithecine from Transvaal, As Determined from the Innominate Bone," by Charles A. Reed and Dean Falk. Vol. 33, No. 23; publication 1252. $1.00

"Tooth Histology and Ultrastructure of a Paleozoic Shark, *Edestus heinrichii*," by Katherine Taylor and Thomas Adamec. Vol. 33, No. 24; publication 1253. $1.75

"New Fossil Polychaete from Essex, Illinois," by Ida Thompson and Ralph G. Johnson. Vol. 33, No. 25; publication 1254. $1.00

"New Information on the *Holocystites* Fauna (Diploporita) of the Middle Silurian of Wisconsin, Illinois, and Indiana," by Terrence J. Frest, Donald G. Mikulic, and Christopher R.C. Paul. Vol. 35, No. 6; publication 1255. $1.75

"*Cyathocrinites* from the Silurian (Wenlock) Strata of Southeastern Indiana, by Terrence J. Frest. Vol. 35, No. 7; publication 1256. $1.75

"Type Fossil Miscellanea (Worms, Problematica, Conoidal Shells, Trace Fossils) in Field Museum," by Gerald Glenn Forney, Daniel Jenkins, and Matthew H. Nitecki. Vol. 37, No. 1; publication 1259. $2.00

"New Agnathous Fishes from the Pennsylvanian of Illinois," by David Bardack and Eugene S. Richardson, Jr. Vol. 33, No. 26; publication 1261. $1.25

"Sedimentary Processes in *Rayonnoceras* Burial," by James H. Quinn. Vol. 33, No. 27; publication 1262. $.75

"*Paraparchites mazonensis* n. sp. (Ostracoda) from Middle Pennsylvanian Ironstone Concretions of Illinois," by I.G. Sohn. Vol. 37, No. 2; publication 1263. $1.25

"*Cacops* (Amphibia: Labyrinthodontia) From the Fort Sill Locality, Lower Permian of Oklahoma," by John R. Bolt. Vol. 37, No. 3 ; publication 1264. $.75

"Type Fossil Coelenterata (Except Corals) in Field Museum of Natural History," by Gerald Glenn Forney, Matthew H. Nitecki, and Daniel T. Jenkins. Vol. 37, No. 4; publication 1265. $1.00

"New Information on the Evolution of the Bradyodont Chondrichthyes," by Richard Lund. Vol. 33, No. 28; publication 1266. $1.00

**Fieldiana Zoology**

"A New Chaenopsid Fish, *Emblemaria hyltoni*, from Isla Roatan, Honduras," by Robert Karl Johnson and David W. Greenfield. Vol. 70, No. 2; publication 1245. (Pub. Dec. 1976.) $.75

"The Larval Characters of Featherwing and Limulodid Beetles and their Family Relationships in the Staphylinoidea (Coleoptera: Ptiliidae and Limulodidae)," by Henry S. Dybas. Vol. 70, No. 3; publication 1247. (Pub. Dec. 1976.) $2.25

"A Phylogeny of Sea Snakes (Hydrophiidae)," by Harold K. Voris. Vol. 70, No. 4; publication 1258. $4.25

"The Differentiation of Character State Relationships by Binary Coding and the Monothetic Subset Method," by Hymen Marx, George B. Rabb, and Harold K. Voris. Vol. 72, No. 1; publication 1269. $1.25

*Circular, slightly concave ear ornament, with mosaic of turquoise, mother-of pearl, lapis lazuli, red* Spondylus *sheel, and possibly jade; border of gold beads. Chimu. Diameter 6.8 cm.*

*Pair of pendants. Ring supports bird with eyes of turquoise. Moche. Height 8 cm.*

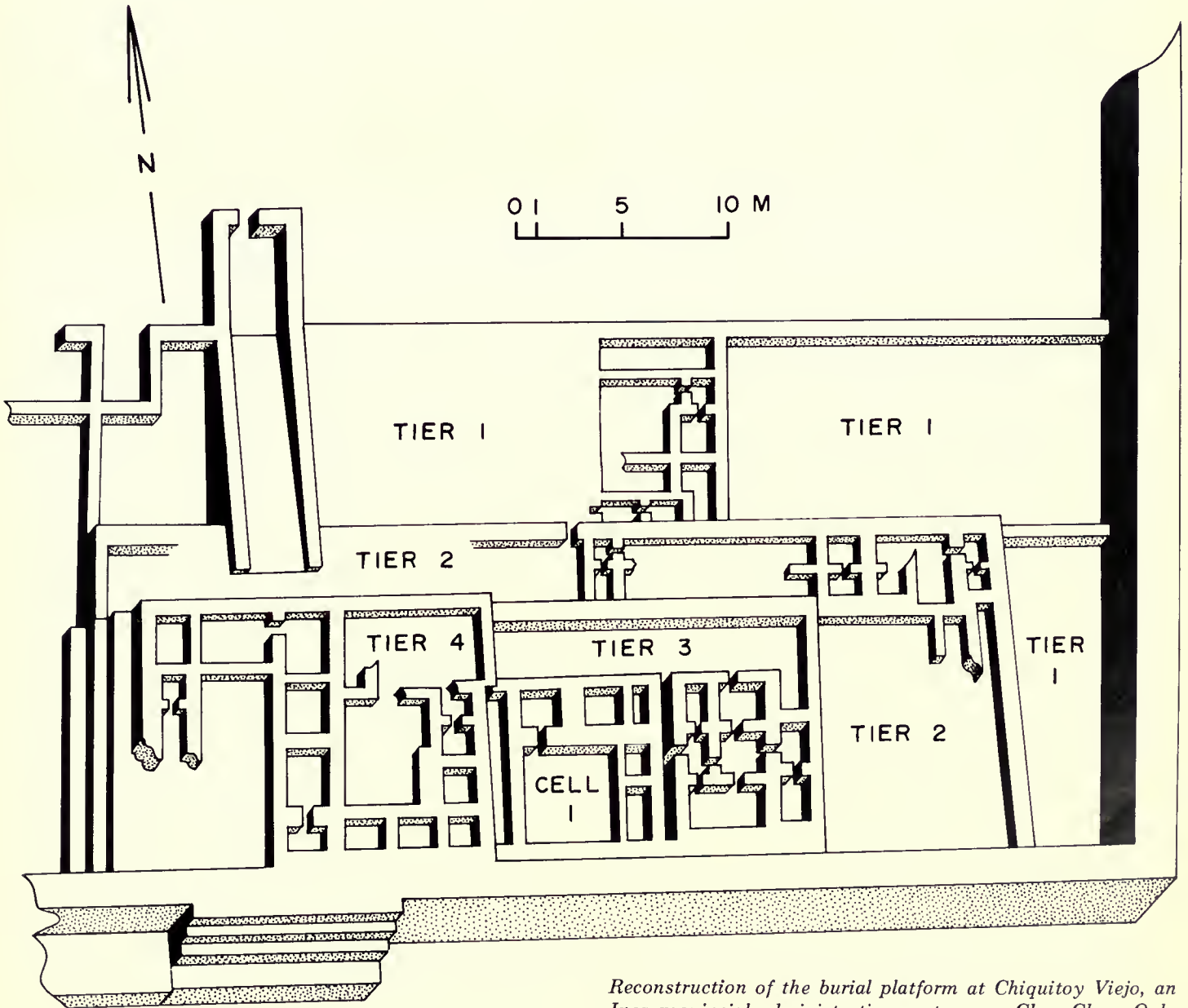
(Continued from p. 11)

ly with the Incas and say little about the Chimu, they help us to understand characteristics shared by the two empires. More specifically, they enable us to identify the great compounds housing Chan Chan's burial platforms and to explain why both sets of structures were built one at a time.

Spanish chronicles relate that the Inca conquest of Chimor coincided with a reorganization of the Inca empire. Chimu administrative principles had been highly sophisticated, and certain aspects of the Inca state seem to have been restructured along Chimu lines.

One of the distinctive features of the revised Inca imperial system was a pattern of "split inheritance" among the royalty. By this, I mean a law of bequeathal based on two dichotomies: state office vs. personal wealth, and principal vs. secondary heirs. In a pattern of split inheritance the principal heir receives the state office, along with the attendant rights and duties, of a deceased administrator. The latter's property and sources of income are granted to his secondary heirs as a corporate group.

Upon the death of an Inca emperor the rights to govern, to wage war, and to impose taxes on the empire passed directly to his principal heir, who became the next head of state. Future claims to the deceased ruler's lands (which were distributed throughout the provinces of the empire), the tax levies instituted in order to farm them, and their produce were bequeathed to a lineage




*Reconstruction of the burial platform at Chiquitoy Viejo, an Inca provincial administrative center near Chan Chan. Only tier 4, the highest part of the platform, was ever used.*

made up of his other descendants. These secondary heirs also received their ancestor's buildings, servants, chattel, and the rest of his possessions. In return, they managed his property in his name, cared for his mummy, and maintained his cult. The new ruler was forced to acquire his own wealth by imposing additional taxes on the existing provinces of the empire or by enlarging his domain through new conquests.

Around the time of the conquest of Chimor the emperor Pachakuti remodelled the Inca capital, Cuzco, to befit its status as the predominant political and religious center of the Andean world. In accordance with the law of split inheritance the "new" Cuzco was planned as a settlement in which each ruler built one or more palaces to be the seat of his government and the center for control of his wealth. After his death his residence(s) passed into the hands of his lineage, while his successor built the next palace or palaces.

I am arguing that Chan Chan was built and governed under a system analogous to the one responsible for the form of Inca Cuzco and that the great compounds of the Chimu capital are equivalent to the palaces of its Inca counterpart. My interpretation, then, is as follows.

The major compounds of Chan Chan were the palaces of the kings of Chimor. Each ruler built one such structure to house himself, be the seat of his government, and serve as the center for the management of his wealth. After his death a king was interred in his burial platform while, in accordance with the law of split inheritance, his palace passed to a lineage composed of his secondary heirs. Important members of this descent group continued to occupy the palace and to manage the deceased ruler's estate; some of these individuals were interred in the secondary-stage addition to their ancestor's burial platform. Meanwhile, the dead ruler's principal heir became the next king of Chimor and built a new palace and burial platform, repeating the pattern.

Hence, the law of split inheritance emerges as the underlying cause of Chan Chan's repetitive pattern of one king—one palace—one burial platform. Still, we are left with a major question: how did the law itself originate?

I believe that the source of split inheritance lies in the combination of two other factors common to the Chimu and Inca empires: divine kingship and a divine right to property. The Chimu and Incas considered their rulers to be divine or semidivine beings. As a demigod, a Chimu or Inca ruler did not completely forfeit his influence when he died. Although he ceased to be head of state, he retained powers and privileges conferred by his divine status. The mummies of past Inca emperors were maintained in state, consulted in times of stress, and brought out to attend important ceremonies, in which they played a vital role. (In fact, these mummies were so revered that the Spanish conquerors eventually went to a great deal of trouble to track down and destroy them.) Likewise, the primary-stage additions affixed to the burial platforms of Chan Chan show that, as members of the state's religious pantheon, the dead kings of Chimor continued to exercise authority in the world of the living. I think it likely that their mummies, like those of their Inca counterparts, were honored participants in major state ceremonies.

In addition, Chimu and Inca rulers had a divine right to property. The punishment for the theft of an Inca emperor's possession, no matter how small or trivial, was death. The Chimu royalty were even harsher: the father and brothers of a thief, as well as anyone who harbored him, were executed along with the criminal himself.

When these two factors were combined, the continuing power of a dead king created certain problems concerning his wealth. That is, in a sense a legal conflict between a deceased ruler and his successor over control of the former's property was inherent in Chimu and Inca culture. Both men had a divine right to property; in the case of the possessions of the dead king, who was still a spiritual presence in the empire, their claims overlapped. This implicit dispute could not be settled on the basis of status, since the two contestants were equals. Therefore, it was settled on the basis of priority. Because the dead king had the earlier claim to his wealth, it remained his property and was given in trust to a lineage of secondary heirs, who managed it for him. Accordingly, split inheritance may be seen as a law formulated to resolve an innate conflict created by the combination of divine kingship and the divine right to property.

One immediate effect of split inheritance should be obvious: by resolving the dispute in favor of the previous ruler, it left the newly enthroned king rich in privileges, but property-poor. Therefore, the law forced an ascending ruler to exercise his property rights by amassing new possessions that would be incontestably his own.

For this reason split inheritance emerges as a principal cause of certain Chimu economic practices. The Chimu showed a constant concern with acquiring agricultural land, either through conquest or through large-scale irrigation projects designed to reclaim farmland from Peru's coastal desert. (For an account of some Chimu irrigation projects see Michael Moseley, "Water-

**PERU'S GOLDEN TREASURES**
***Members' Preview***
Wednesday, Feb. 15

ways of Ancient Peru," *Field Museum of Natural History Bulletin,* March 1977.) If a newly crowned king owned no real property, his best opportunity lay in obtaining agricultural land to support the workers who could provide him, and eventually his lineage of secondary heirs, with tangible wealth.

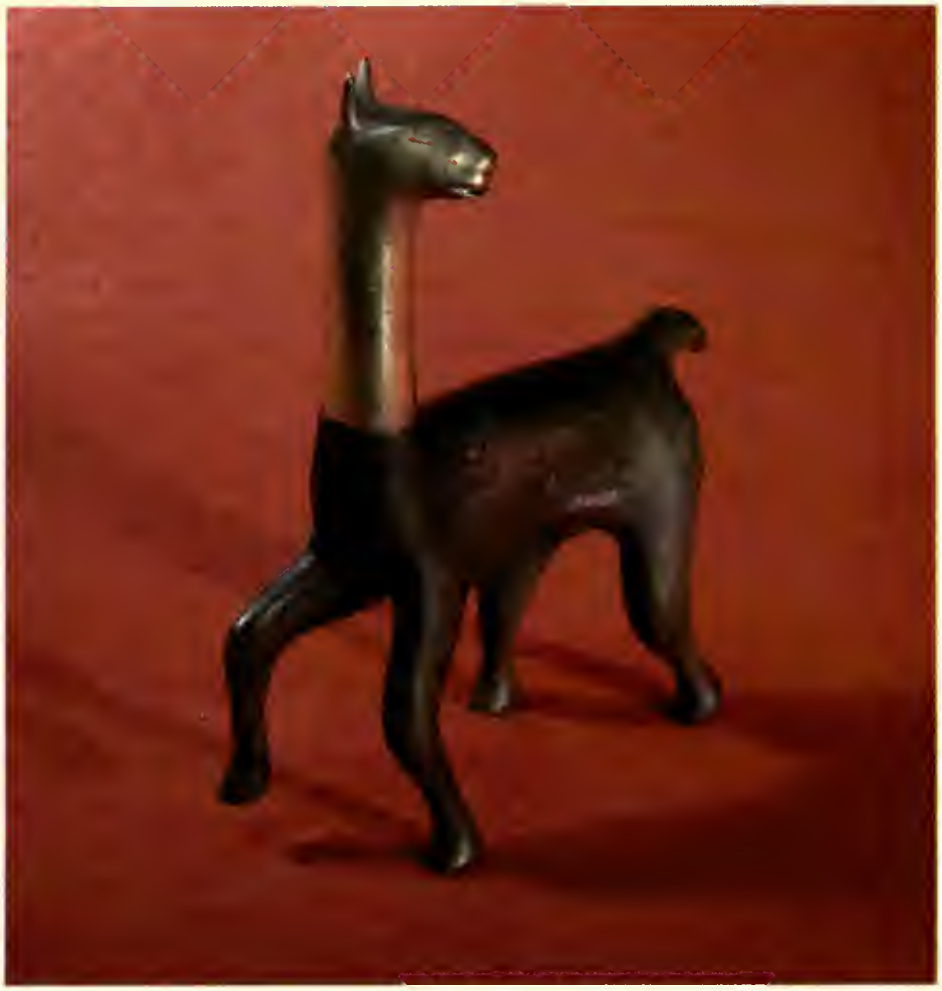
To date, only a few burial platforms have been found outside Chan Chan. While these structures are not royal funeral mounds, they also offer insights into factors such as social and political organization. For example, Spanish chronicles suggest that Inca provincial administrators were subject to a modified form of split inheritance. The chief difference between the royal and provincial patterns seems to lie in the items actually owned by rulers and lower-level administrators.

Archaeological information relevant to this problem comes from the site of Chiquitoy Viejo, a large compound in the Chicama Valley, about 25 kilometers north of Chan Chan. Our excavations in late 1971 showed that this site was a provincial administrative center established by the Incas after their conquest of Chimor. In keeping with Inca practices, the official based at Chiquitoy Viejo was probably a local Chimu noble co-opted into the Inca government. This idea is supported by the presence of a burial platform at the site; such structures were a Chimu, not Inca, tradition.

The burial platform at Chiquitoy Viejo is quite different from those of Chan Chan. The Chiquitoy Viejo platform was built in four tiers, and the larger tiers at the bottom were divided into separate subsections. The entire structure has been heavily damaged by looters, and the exact arrangement of all its cells would not be apparent without more work than we undertook. Nonetheless, each of the two highest tiers, along with each subsection of the lower tiers, seems to contain one principal chamber surrounded by secondary cells. (In contrast to Chan Chan, the principal chambers At Chiquitoy Viejo are not T-shaped, but simply rectangular cells larger than the surrounding ones.) This pattern argues that while a Chan Chan burial platform was built for one individual, a king of Chimor, Chiquitoy Viejo's mound was designed for the burial of a series of important individuals over a considerable span of time. As each of these persons died, he was to be interred in the principal cell of his section of the platform. Offerings and sacrifices were to be installed with him and in the adjacent secondary chambers.

While the platform was designed for extended use, archaeological evidence shows that it actually had a relatively short life. The cells in most of the platform remain open to the sky. Only one section—the highest tier—was capped with a tapia block. (Tapia is the prehistoric Peruvian equivalent of concrete, a mixture of mud and gravel poured into wooden forms that were removed once the mud had dried. In essence, a tapia block is a giant adobe brick.) Even more striking is the distribution of bones and artifacts. These materials are most densely concentrated in and around the capped section. Other sectors contain only scattered materials in looters' backdirt piles. As one moves further away from the capped section, bones and other remains become increasingly scarce. It seems that only the capped section was ever used, and that only one important person was actually buried in the platform.

*The burial platform at Chiquitoy Viejo, seen from the north. The highest part of the patform is what remains of the tapia cap atop tier 4. Most of the damage visible here was inflicted by looters.*



*Cast figure of llama. Head and neck are of gold, body is silver. Inca. Height 11.4 cm. This figure is in Field Museum's permanent collection. Cat. no. 2402.*

Left: *Sheet-gold figurine holding beads, possibly of jade. Lambayeque style. Chimu. Height 4 cm.* Right: *Embossed figurine of warrior. Chimu. Height 4 cm.*

*Mask with stylized human face bordered by snakes. Possibly Inca. Height 22 cm.*

*Stirrup-spout ceramic bottle depicting man riding reed boat. Moche. Height 21.6 cm. This figure is in Field Museum's permanent collection. Cat. no. 1217.*

This conclusion fits neatly with data from another part of the compound, an administrative unit adjacent to the west side of the burial platform. This unit contains two U-shaped rooms that served as administrative "offices." Interestingly, the unit originally had only one such room. Eventually a wall without doorways was erected around this first room, shutting it off from the rest of the compound, and a second office was built as a replacement.

I interpret these facts as indications that Chiquitoy Viejo was the seat of an important Inca provincial post held sequentially by two men. The first administrator governed from the original U-shaped room. When he died, his office was sealed, and he was interred in his section of the burial platform. His successor built the second U-shaped office room. Presumably, this second administrator planned to be buried in a separate section of the platform. Before he died, however, Chiquitoy Viejo was abandoned, probably as a result of the social and political disruption caused by the Spanish conquest.

The history of Chiquitoy Viejo indeed seems to conform to a modified law of split inheritance. The compound as a whole was a state-owned administrative complex, not the personal property of the resident official. Therefore, in contrast to the death of a Chimu king, the demise of the Inca administrator at Chiquitoy Viejo did not require the construction of a new compound and burial platform. However, the actual office room occupied by the local official was in some way personally identified with him. It could not be used by his successor, who did have to build his own U-shaped room. Similarly, the prestigious goods accumulated by the first administrator were considered to be his personal property and were installed with him in his section of the burial platform. The new administrator had to obtain his own possessions during his years in office.

Recently yet another burial platform has been identified at the site of Farfán, a major Chimu provincial administrative center in the Jequetepeque Valley, about 100 kilometers north of Chan Chan. There are six large compounds at Farfán, but only one contains a burial platform. The implications of this pattern are still unknown. Did each succeeding chief administrator build his own compound, or did they all govern from one enclosure, with other compounds serving other purposes? Was the burial platform, like that of Chiquitoy Viejo, divided into sections for sequential use by the head officials at Farfán? Or was the entire platform a special privilege awarded by the king of Chimor to one man, perhaps the conqueror and first governor of the Jequetepeque Valley? Were Chimu provincial administrators in fact subject to a modified law of split inheritance? The answers to these questions must await the excavation of Farfán. Clearly, we have only begun to tap the information embodied in the elaborate burial platforms of Peru's north coast. □


# Gamelan Master Class for Adults

An introduction to Indonesia's remarkable orchestral ensemble, including basic techniques of performance, musical structure, and the cultural background of gamelan music in social and ceremonial uses. To be offered on Thursday mornings, 10:00 a.m. to noon, for 10 weeks, March 2 through May 4. When the course is completed, the master class will give a public concert. The class is limited to 16 persons. (Registrants should be physically able to remain seated on the floor—the position for playing many of the instruments.) Reservations will be confirmed upon receipt of check: $60.00 for members, $75.00 for nonmembers.

Send coupon below (or facsimile) to GAMELAN, Field Museum of Natural History, Roosevelt Road at Lake Shore Drive, Chicago, Il. 60605.

Name _____

Address _____
street city state zip

Phone _____
daytime evening

Check enclosed ☐ Member ☐
Nonmember ☐

Please enclose self-addressed, stamped envelope.

# *February & March at Field Museum*

*(February 15 through March 15)*

### New Exhibits

**Peru's Golden Treasures**—opens February 16 (Members' preview February 15). A dazzling collection of 225 pre-Columbian gold artifacts on loan from the Museo Oro del Peru, Lima, Peru, comprises the largest collection of its kind ever to be shown in the United States. Augmenting the Museo Oro del Peru pieces, which survived the Spanish conquest of Peru in 1532, are more than 50 antiquities from Field Museum's own collections and from those of the Peabody Museum at Harvard. Hall 26. 2nd floor. Through May 21.

### New Programs

**Spring Journey for Children: Exploring the Ancient Andes**—February 16 through May 31. Free self-guided *Journey* leads children and families through museum exhibits to learn about the lifestyles of ancient Andean cultures. *Journey* pamphlets are available at the information booth, main floor.

**Discovering the Moche**—Fridays and Sundays, February 17 through May 21, at 11 a.m. and 2 p.m. Short documentary film interprets the symbolism on pottery made by Peruvians 1,000 years before the Incas. Shown in conjunction with the *Peru's Golden Treasures* exhibit. Simpson Theatre, ground floor west.

**Potato Planters**—Fridays and Sundays, February 17 through May 21, at 11 a.m. and 2 p.m. Short documentary film surveys the modern Peruvian Aymara Indians who still live like their pre-Columbian ancestors. Shown in conjunction with the *Peru's Golden Treasures* exhibit. Simpson Theatre, ground floor west.

**Peruvian Music Performance**—February 18, at noon and 3 p.m. La Pena Peru, a group of local Peruvian musicians, performs coastal criollo music—a combination ot Indian, Spanish, and African influences. The performance is in conjunction with the *Peru's Golden Treasures* exhibit. Stanley Field Hall, main floor.

**Lords of the Labyrinth**—every Saturday from February 18 through May 21, at 11 a.m. Newly released BBC-TV production features new developments in recent archaeological fieldwork by Field Museum anthropologists on the north coast of Peru. Shown in conjunction with the *Peru's Golden Treasures* exhibit. Simpson Theatre, ground floor west.

**Land of the Rio Grande**—February 26, 2:30 p.m. The Illinois Audubon Society presents a free film lecture about one of the largest and most scenic rivers in the United States. Simpson Theatre, ground floor west.

**The Art of Basketmaking**—February 25 and 26. Pacific Northwest Coast basketry methods will be demonstrated in the *Basketry of the Northwest Coast Indians* exhibit (Hall 27) from 10 a.m. to noon and 1 p.m. to 3 p.m.

### Last Chance to See

**Monkeys Inside and Out**—closes February 22. Exhibit of illustrations of monkeys appearing in the recently published *Living New World Monkeys*, Vol. 1, by Philip Hershkovitz, emeritus curator of mammals. Hall 9.

**Exotic Flyers: Portraits of Neotropical Birds**—closes February 22. Exhibit of exquisite bird illustrations appearing in the recently published *Manual of Neotropical Birds*, Vol. 1, by Emmet R. Blake, emeritus curator of birds. Hall 9.

### Continuing Exhibits

**Basketry of the Northwest Coast Indians.** This exhibit features more than 100 basketry items made mostly around 1900 by Indians of the Northwest Coast (southwestern Alaska to northern California). The three major basketry techniques—plaiting, twining, and coiling—are represented, along with raw materials and tools. Hall 27, 2nd floor.

**Field Museum Gamelan.** Field Museum's 130-year-old Javanese gamelan, an ensemble of 24 fine bronze and wood musical instruments, has been completely restored for exhibition. It is the oldest and perhaps finest gamelan outside Indonesia. An audio tape of gamelan music supplements this permanent exhibit. Hall K, ground floor.

**Pawnee Earth Lodge.** This permanent exhibit, in Hall 5, is a traditional Pawnee earth lodge—the home and ceremonial center of Pawnee Indians as it existed in the mid-1800s. Daily programs provide opportunities to learn about Pawnee culture. New public program hours: Monday through Friday, 1:15 p.m.; weekends, 11 a.m. and 1:15 p.m. Tickets may be picked up 15 minutes prior to the program at the north information booth. Programs limited to 30 people.

**The Place for Wonder.** This gallery provides a place to handle, sort, and compare artifacts and specimens. Weekdays, 1 p.m. to 3 p.m.; weekends, 10 a.m. to noon and 1 p.m. to 3 p.m.

**Male and Female: Anthropology Game.** The exhibit where visitors become anthropologists. Discover that economic and social roles of the sexes are not universally the same. Ground floor, near elevator.

*Calendar continued on back cover*

# *February & March at Field Museum*

*(CALENDAR continued from inside back cover)*

### Continuing Programs

**On Your Own at Field Museum.** Self-guided tour booklets, adult- and family-oriented, available for for 25¢ each at entrance to the Museum Shop, main floor north.

**Weekend Discovery Programs.** Guided tours, demonstrations, and participatory activities. Every Saturday and Sunday, 10 a.m. to 3 p.m.

**The Ancient Art of Weaving.** Weaving and spinning demonstrations every Monday, Wednesday, and Friday, 10 a.m. to noon. South Lounge, 2nd floor.

**Gamelan Adult Master Class**—Thursdays, March 2 through May 4, from 10 a.m. to noon. Beginning basic techniques of performance, an understanding of musical structure, and the cultural background of gamelan music in social and ceremonial uses will be covered. A public concert will be given by the master class upon completion of the course. Members' fee, $60.00; nonmembers', $75.00. (Additional information and application form appears on page 26.)

**Peru's Golden Treasures Lecture Series**—Fridays, March 3, 10, and 17, at 8 p.m. Renowned experts in the field of South American ethnology and archaeology lecture on various aspects of ancient Peruvian culture and history. Series tickets: Members $7.00; nonmembers $10.00. Single tickets: Members $2.50, nonmembers $3.50 each.

A special dinner at 6 p.m. is available for Members before each lecture, at $7.00 per person. (Additional information and application form appears on pages 16-17.)

**Ayer Illustrated Lecture Series**—Saturdays, March 4 through April 29, at 2:30 p.m. Enjoy an adventurous but relaxed afternoon touring the world while comfortably seated in the museum's Simpson Theatre, ground floor west. Doors open at 1:45 p.m. A limited number of reserved seats are available for Members on days of the lectures until 2:25 p.m.

| | | | |
|---|---|---|---|
| March 4 | *Treasures of Italy*<br>by Kenneth Richter | March 11 | *India*<br>by Jens Bjerre |

**Audio Information System.** The museum's newly installed audio system, *Uniguide*, enables visitors of all ages to visit selected exhibits in any sequence. Audio receivers and maps available for $1.25 per person, $3.75 for a family of up to five at the entrance to the Museum Shop, main floor north.

### February and March Hours

**The Museum Opens** daily at 9 a.m. and closes 5 p.m. every day except Friday. On Fridays, the museum is open to 9 p.m.

**The Museum Library** is open weekdays 9 a.m. to 4 p.m. Obtain a pass at reception desk, main floor.

**Museum telephone:** (312) 922-9410.

March
1978

# Field Museum of Natural History Bulletin

**Field Museum of Natural History Bulletin**

March 1978
Vol. 49, No. 3

*Editor/Designer:* **David M. Walsten**
*Production:* **Oscar Anderson**
*Calendar:* **Nika Semkoff Levi-Setti**
*Staff photographer:* **Ron Testa**

**Field Museum of Natural History**
Founded 1893

*President and Director:* **E. Leland Webber**

BOARD OF TRUSTEES

William G. Swartchild, Jr., *chairman*
Mrs. T. Stanton Armour
George R. Baker
Robert O. Bass
Gordon Bent
Harry O. Bercher
Bowen Blair
Stanton R. Cook
O.C. Davis
William R. Dickinson, Jr.
Thomas E. Donnelley II
Marshall Field
Nicholas Galitzine
Paul W. Goodrich
Hugo J. Melvoin
William H. Mitchell
Charles F. Murphy, Jr.
James J. O'Connor
James H. Ransom
Mrs. Joseph E. Rich
John S. Runnells
William L. Searle
Edward Byron Smith
Robert H. Strotz
John W. Sullivan
Edward R. Telling
Mrs. Theodore D. Tieken
E. Leland Webber
Julian B. Wilkins
Blaine J. Yarrington

LIFE TRUSTEES

William McCormick Blair
Joseph N. Field
Clifford C. Gregg
Samuel Insull, Jr.
William V. Kahler
Remick McDowell
J. Roscoe Miller
James L. Palmer
John T. Pirie, Jr.
Donald Richards
John M. Simpson
J. Howard Wood

CONTENTS

3 **Field Briefs**

4 **Adventures in Patagonia**
Paleontologist Elmer S. Riggs and Field Museum colleagues encounter more than fossils during 1920s expedition
*By Larry G. Marshall*

12 **Volunteers Honored**

14 **The Devil's Doorway: Then and Now**

16 **Life in the Pre-Columbian Town of Galindo, Peru**
*By Garth Bawden*

24 **The Conservation of a Woven Hat Cover**
*by Christine Danziger, conservator, and Jim Hanson, clerical staff, Department of Anthropology*

25 **Shadow Puppet Performances**

26 **Our Environment**

27 **March and April at Field Museum**
Calendar of coming events

COVER

Portion of lower wing, upper surface, of *Telea polyphemus*, large saturniid moth common to North America. Enlarged about 25 times. Photo by James Swartchild, Field Museum volunteer.

*Field Museum of Natural History Bulletin* is published monthly, except combined July/August issue, by Field Museum of Natural History, Roosevelt Road at Lake Shore Drive, Chicago, Il. 60605. Subscriptions: $6 a year; $3 a year for schools. Museum membership includes *Bulletin* subscription. Opinions expressed by authors are their own and do not necessarily reflect the policy of Field Museum. Unsolicited manuscripts are welcome. Postmaster: Please send form 3579 to Field Museum of Natural History, Roosevelt Road at Lake Shore Drive, Chicago, Il. 60605. ISSN: 0015-0703.

*Field Museum volunteers Hermann C. Bowersox and William E. McCarthy assisted in the editorial preparation of this issue.*

# FIELD BRIEFS

### Swartchild Elected Board Chairman

William G. Swartchild, Jr., a Field Museum trustee since 1966 and a vice chairman of the Board of Trustees since 1974, was elected chairman of the board at its meeting January 16. He succeeds Blaine J. Yarrington, chairman since 1974.

A native Chicagoan, Swartchild is retired from active business. He is a graduate of Dartmouth College, Hanover, N.H., and a member of Phi Beta Kappa. He is married to the former Beatrice Wolbach; they have one son, William III, of Riverside, Conn.

Swartchild's eleven years' service on the Board of Trustees has included chairmanship of the Program Planning and Evaluation Committee as well as membership on several other committees. He is also active in the American Association of Museums; as a member of the Trustee Subcommittee of that association he helped prepare a recently completed comprehensive code of ethics for museum personnel and volunteers.

Swartchild is currently chairman of the board of Children's Memorial Hospital, chairman of the board of Northwestern University's McGaw Medical Center, a trustee and chairman of the Academic Affairs Committee of Michael Reese Hospital, and a board member and chairman of the Finance Committee of Blue Cross-Blue Shield.

Mrs. Swartchild is a member of the Women's Board of Field Museum and a volunteer. James Swartchild, William's brother, is also a field Museum volunteers and well known for his photographic work. (the cover photo of this issue of the *Bulletin* is by James Swartchild.)

Blaine J. Yarrington, William Swartchild's predecessor as chairman, has been on the board since 1970; he will continue as a trustee and serve on the Public Affairs and Investment Committees.

At the January 16 board meeting the following trustees were elected to new offices: James H. Ransom, vice chairman (internal affairs) and John W. Sullivan, vice chairman (facilities planning). Those continuing in office were Bowen Blair, vice chairman (resource planning and development); James J. O'Connor, vice chairman (public affairs); John S. Runnells, vice chairman (program planning and evaluation); Mrs. Theodore Tieken, secretary; Edward Byron Smith, treasurer; and Leland Webber, president and director.

*William G. Swartchild, Jr.*

James Swartchild

### John G. Searle

Field Museum lost a long-time friend and benefactor with the death of John G. Searle on January 21. Mr. Searle, a trustee since 1951, died at his winter home in Hobe Sound, Florida, at the age of 76. He was elected to the Board of Trustees in 1951 and made a life trustee in 1971.

Searle was retired chairman of G. D. Searle & Co., of Skokie, Ill., a pharmaceutical firm founded by his grandfather. Earlier, he had been president of the firm. He is survived by his wife, Frances; two sons, William and Daniel; and a daughter, Mrs. Suzanne S. Dixon. His son William is a Field Museum trustee.

Mr. Searle was one of the Museum's major donors, though he always wished that his contributions be anonymous. Throughout his active years as a trustee he demonstrated strong interest in and support of the institution's research program. In appreciation of this interest

*John G. Searle*

and of his generous contributions, the Field Museum herbarium—the Museum's collection of preserved plants—was named the John G. Searle Herbarium in 1972. In constant use by scientists of many countries who either visit or to whom loans of specimens are sent, this herbarium is one of the world's outstanding botanical research collections. Currently under renovation as part of the Museum's building program, the John G. Searle Herbarium will remain as a permanent memorial to one of Field Museum's major builders.

### Peru's Golden Treasures Group Viewings

Do you know of a group of 30 to 50 persons whom you, as a Field Museum member, would like to "host" for a viewing of the current Peru's Golden Treasures exhibit (through May 21)? Viewings may be supplemented with a specially arranged lecture for your group as well as a meal. For group rates and additional information call 922-0733.

# ADVENTURES IN PATAGONIA

*Field Museum paleontologists encounter more than fossils during their first expedition to South America, 1922-24.*

**By Larry G. Marshall**

"It is said that there was open rebellion in this territory a year ago and some 400 men were executed. . . . Please do not communicate this to our families." So wrote Elmer S. Riggs, Field Museum paleontologist, on January 3, 1923, shortly after setting up base camp at Río Gallegos, in southern Argentina. A cause for anxiety? Probably so for the letter's recipient, D. C. Davies, then Field Museum's director. It had not been many years since another curator, anthropologist William Jones, had been murdered while doing field work in the Philippines.*

Now, Elmer Riggs and two Department of Geology preparators, John B. Abbott and George F. Sternberg, were beginning two years of field work in a new land. It was to be an undertaking full of surprises and disappointments, as well as unexpected pleasures.

Their objective was to make extensive collections of fossil mammals from Argentina and Bolivia. And where to begin such an endeavor? Naturally, in a locale known for the presence of fossils of a particular geological age: in a place like Patagonia—the southernmost 900 miles of Argentina east of the Andes and north of the Straits of Magellan.

---

*See "Why Was William Jones Killed?" by Barbara Stoner, September 1971 *Bulletin*.

*The great barranca, or cliff, in central Patagonia—the most important fossil locality in South America.* Larry G. Marshall

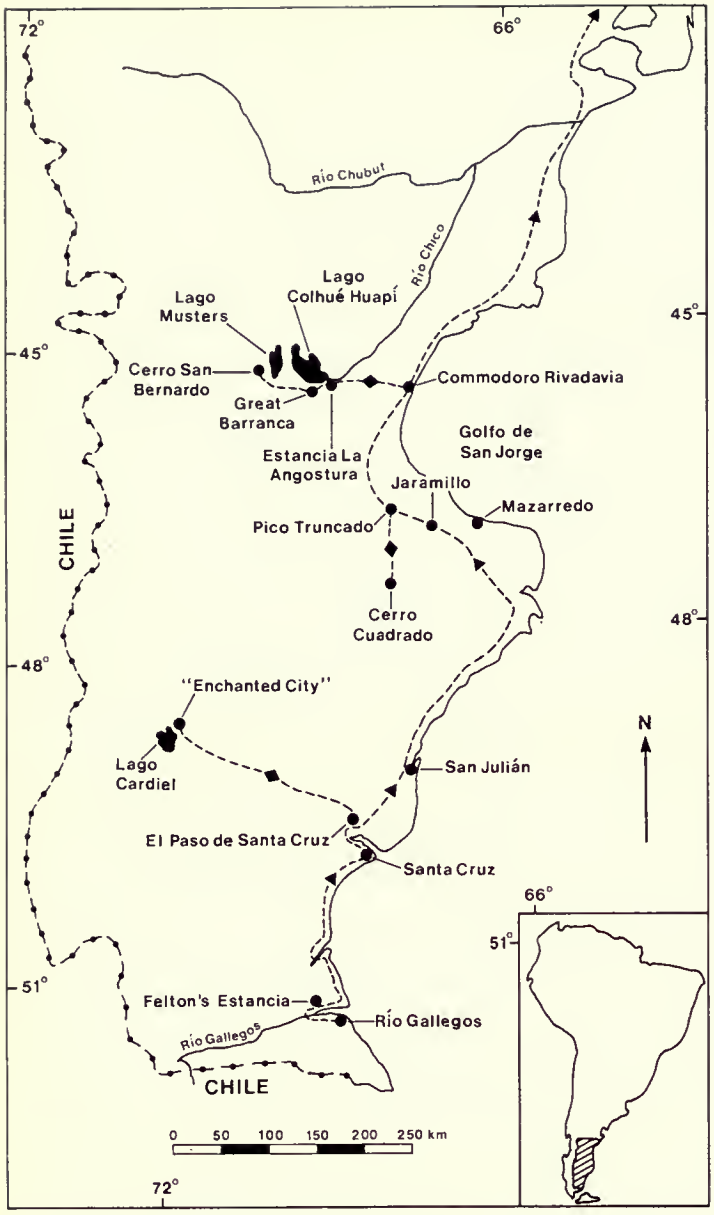
This part of the world, long viewed as a no-man's-land, first came under serious scientific scrutiny in 1833, when the H.M.S. *Beagle* sailed along the Argentine coast to do geodetic surveys. Aboard the *Beagle* was a young English naturalist, Charles Darwin, whose responsibilities included the collecting of natural history specimens. By the time the *Beagle* departed Argentine waters Darwin had accumulated an impressive array of fossil specimens that were entirely new to science. Subsequently, the specimens were classified and named by the eminent British anatomist, Sir Richard Owen.

Largely as a result of Darwin's discoveries, it was recognized that the Patagonian fauna was distinctly different from the fauna of the rest of the world, a fact which suggested that the region had been geologically isolated for a long period of time. Recent geological evidence supports the view that South America was, indeed, an "island continent" during most of the last 65 million years of earth's history.

However, not until the pioneering work of the Argentinian brothers Carlos and Florentino Ameghino, which took place more than 50 years after Darwin's visit,

---

Larry G. Marshall, who has also collected fossils in Patagonia, is a visiting curator in the Department of Geology.




*Patagonian itinerary of the Marshall Field Paleontological Expedition to Patagonia (1922-24).*

did the world of science begin to appreciate the wealth of fossil mammals occurring in Patagonia. Carlos Ameghino, the younger brother, made 16 expeditions into Patagonia, the first occurring in 1887. Florentino, in turn, wrote voluminously on the collections made by his brother.

Beginning in 1896, paleontologists from other countries began collecting in the region. John Bell Hatcher, of Princeton University, made three expeditions between 1896 and 1899. André Tournouër, of France, made five trips to southern Argentina between 1899 and 1904, collecting for the Paris Museum of Natural History. In 1904, Handle T. Martin of Topeka, Kansas, collected along the Río Gallegos. Many of his specimens are now in the University of Kansas Natural History Museum, at Lawrence.

The next major expedition to this region was Field Museum's "Marshall Field Paleontological Expedition to Patagonia (1922-24)," led by Riggs. When authorization for the Field Museum expedition came through in July, 1922, Riggs, Abbott, and Sternberg were on another fossil-hunting venture in Alberta, Canada. They lost no time in packing their specimens and hustled back to Chicago. On November 15 the expeditioners embarked at Hoboken, New Jersey, for a 17-day voyage to Buenos Aires.

Riggs had no sooner arrived in Argentina than he learned of a new law that could seriously restrict the collecting of fossil and archaeological specimens by foreign institutions. The law stipulated that field work could be prohibited in certain areas, that all collected material had to be inspected by Argentine officials before it could be shipped out of the country, that any specimens new to science could be confiscated, and that half of any series of desirable specimens could be withheld.

If rigidly enforced, such a set of regulations could greatly limit or vitiate Riggs' collecting efforts. He secured formal permission to proceed, but only after 23 days of wading through government red tape in Buenos Aires and satisfying Argentine officials that Field Museum's endeavor was an honorable one.

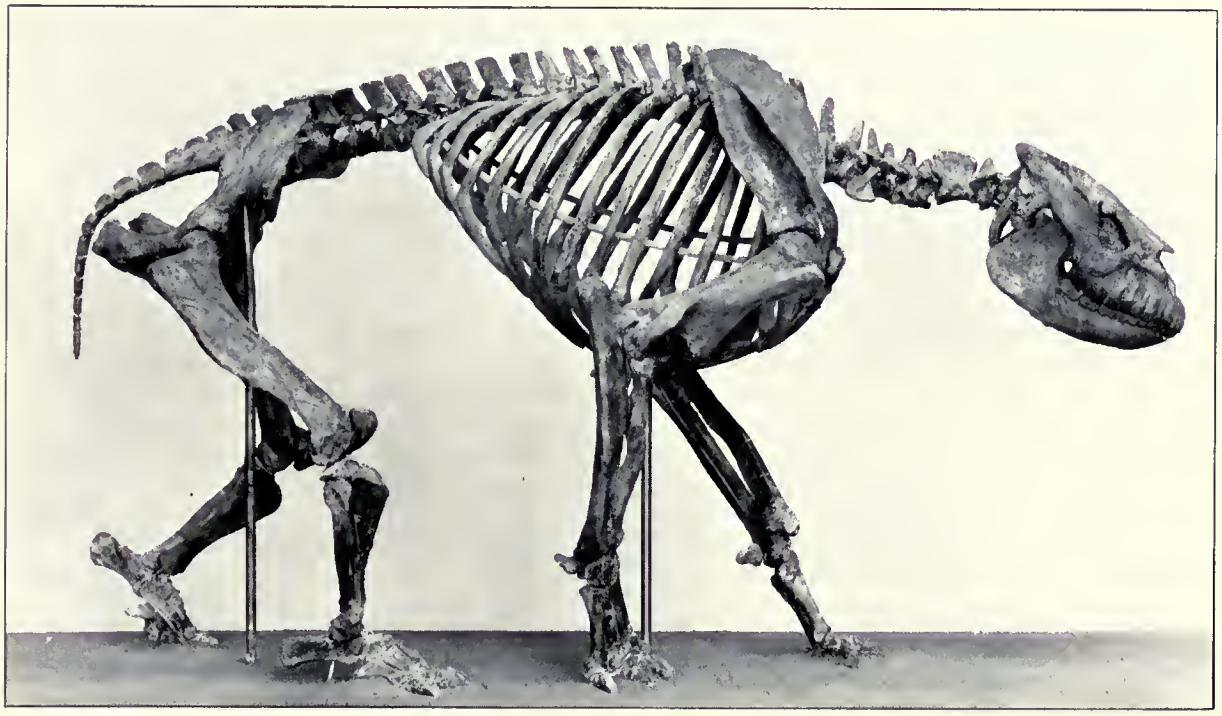
Following the route of Hatcher, Riggs established his first camp in January, 1923, at the estancia, or sheep ranch, of Don Charles Felton, on the north bank of the Río Gallegos, some 40 miles from the city of Río Gallegos. His first collecting was done along the north bank of the river in what is known as the Santa Cruz Formation, created during the early Miocene epoch, some 20 million years ago. Most fossils came from the lower 25 feet of the formation, which was exposed near the river's waterline.

Two of the fossils discovered by Riggs in this formation—the herbivorous mammals *Astrapotherium* and *Homalodotherium*—are of particular interest because relatively complete skeletons of these animals were collected. (The reconstructions of these two fossils are on view in Hall 38.) *Astrapotherium* stood nearly five feet in height and was about 9½ feet long. It was large-headed and long-bodied, and its mouth was armed with four strong tusks somewhat like those of a wild boar. The forefoot had five toes which were probably enclosed in a fleshy pad like that of an elephant. The hind legs were more slender than the forelegs and the entire hindquarters were relatively light. Remains of this animal were found in lagoon and stream channel deposits. This fact, together with the features of padded feet and a kind of dentition suitable for chewing soft, lush vegetation, suggest that *Astrapotherium* was the South American "hippopotamus" of its time.

*Homalodotherium* was a sturdy, heavy-bodied, strong-limbed creature with the proportions of a bear and about as tall as an ox. Its head was similar in proportion to that of certain extinct members of the rhinoceros family. Its grinding teeth were of the sort associated with a vegetation diet, and it had neither tusks nor horns for defense. The hind legs were relatively short and stout, longer in the thigh and shorter in the lower leg. The bear-like hind feet could be firmly planted on the ground and were well adapted for supporting the body in an activity such as digging for roots or for rearing upright so that the upper limbs could pull down branches, presumably to feed on foliage or fruit.

SHORTLY AFTER RIGGS' ARRIVAL in Río Gallegos, a certain J. G. Wolfe introduced himself and offered his services to the expedition. Wolfe claimed to have been a museum curator in Río Gallegos and to have held a commission in the Argentine army. But what aroused Riggs' interest, more than his credentials, was Wolfe's description of a "Tertiary human skull" and an "enchanted city." Riggs decided to investigate these curiosities, though with reservations.

They set out for El Paso de Santa Cruz, the settlement where the skull had apparently been found. The proprietor of a local hostelry recalled that the skull had first attracted notice about 1916 and had been discovered in a roadbed near town. The first person to suspect that it might be of scientific value was said to have been an English nurse, a Mrs. Vendrino, who had worked in the area for some years. She obtained custody of the skull and it was in her possession when Wolfe had examined it earlier.



Homalodotherium *reconstruction on view in Hall 38. Like* Astrapotherium, *below, it lived in Patagonia during Miocene times. Both fossils were found by Riggs and his associates in 1923.*

Astrapotherium *reconstruction on view in Hall 38. Occurring some 20 million years ago in what is now Patagonia, it was the South American "hippopotamus" of its time.*

◄ *Elmer Riggs examines fossil skull and jaw collected in Patagonia.*

*Field Museum's Elmer S. Riggs, John B. Abbott, and George F. Sternberg (standing: second, third, and fifth from left) enjoy some South American hospitality while visiting an Argentine meteorological station at Colonia Sarmiento. Their hosts are seated.* ►

*John B. Abbott excavating dinosaur femur in January, 1924. This huge thigh bone is on permanent view in Stanley Field Hall, where it is designated the "touch bone."* ▼

In El Paso de Santa Cruz, Riggs—who was becoming increasingly suspicious of the alleged skull—was told that Mrs. Vendrino had recently "gone mad" and had been taken to Buenos Aires for treatment. She had taken her treasured, 22-pound skull along as a trophy. Eventually, Riggs was able to track down the "skull," and his suspicions were confirmed: it was just a very curious stone, with a remarkable humanoid shape.

From El Paso, the Riggs party now proceeded 175 miles northwestward to Lago Cardiel, in search of Wolfe's "enchanted city." Once there, Riggs experienced another disappointment as the "city" proved to be nothing more than an intrusive bed of lava, or *dike*, as it is known in geological parlance. The "city" filled a fissure in the surrounding clays and had subsequently been laid bare by erosion. Local residents saw nothing unusual in it, for a number of similar structures were to be found in the area.

Perhaps naive, perhaps an eternal optimist, or possibly just the victim of a kind of salesmanship, Riggs was now intrigued by Wolfe's account of an "ancient cemetery" of fossil mammals. They proceeded over a circuitous route to the camp of an amateur fossil collector, a man who had worked with paleontologist Carlos Ameghino some 25 years earlier. On the second night out, the party realized that they had travelled almost in a circle and were now six miles from their starting point. The search for the ancient fossil "cemetery" was forthwith abandoned and Riggs drew these belated conclusions about Wolfe:

"He betrays no evidence of scientific training, [and] is particularly lacking in ability to recognize and interpret natural objects and to derive data from them. His method . . . has been to get theories from reading and then to cast about for some object to fit into the theory. . . . Dr. Wolfe has impressed us as an enthusiast with a wanderlust and no purpose beyond gratifying it. He studied law . . . but found that profession too tame and colorless to suit his fancy. He . . . apparently wrote extravagant stories in order to sell them. He is already, so he says, under fire of criticism of a leading scientist in Buenos Aires." When the party returned to Río Gallegos, Wolfe was dismissed.

Later in the year, the expedition set up camp near the Estancia La Angostura, on the south bank of the Río Chico del Chubut. Here, new surprises awaited them. They pitched camp not far from some bluffs of gray shale, and on the day of their arrival Abbott was already climbing about the bluffs and inspecting them. He hurried back to report the presence of dinosaur bones.

The next day, Abbott and Riggs examined the bluffs more thoroughly. Bones of large dinosaurs were indeed there—they had been dug out of the shale and

*Although bleak and forbidding in aspect, the Santa Cruz Formation along Patagonia's Atlantic coast is good fossil country.*

*Family of Welsh immigrants posed in their Sunday best before their Patagonian home.*

*"Bones of large dinosaurs . . . had been dug out of the shale and placed in orderly piles, . . . with no mark of ownership and exposed to the elements."*

placed in orderly piles nearby! There the bones sat, with no mark of ownership and exposed to the elements. Sun, rain, and wind had weathered them so that they were now falling into decay. Three or four thousand pounds in all, this accumulation represented no small effort on the part of an earlier collector. Local residents remembered that some work had been done there about 20 years earlier, but no one knew who the fossil-hunter had been, where he had come from, or what fate had befallen him.

A few days later Riggs and Abbott discovered their predecessor's deserted camp. A ring of stones marked the outlines of a *tolda*, or bush shelter, such as those made in earlier times by Indians and which were still used by local shepherds as temporary camps. Bits of reed matting lay among the stones. A drift pick, shovel, and two hammers bore testimony to an earlier expedition—all carried the trade mark of a Sheffield, England, toolmaker; they also found a badly rusted ring bolt and the iron handles of a chest. These were the only clues to the identity of the man who had worked the bluffs two decades earlier, only to leave the fruits of his labor abandoned. Had he fallen ill and died? Had he abandoned his work in a fit of despair or when funds ran out? Had he been set upon by thieves?

The place had an eerie air about it, and besides, the expedition's main objective was mammals, not dinosaurs. In any case, the party soon packed up their gear and headed southwest about 20 miles to a particular barranca, or cliff, which has come to be recognized as the most important single fossil locality in all of South America. This barranca, south of Lago Colhué-Huapí, extends westward from the source of the Río Chico del Chubut to a point south of Lago Musters. The remarkable feature of this barranca is that faunas of four distinct, successive ages of land mammals occur there, superimposed one upon the other.

Toward the end of January, 1924—after more than a year in the field—the expedition moved westward to explore the terrain surrounding the San Bernardino Mountains west of Lago Musters. All of the fossil beds encountered in this area were Cretaceous in age (135 million to 63 million years old) and although the party encountered no fossil mammals, they did find dinosaurs. Several well preserved femurs (upper bones of the hind leg) were collected at a point 10 to 12 miles northwest of Cerro San Bernardino. One of these femurs (the "touch bone"), weighing nearly half a ton, is now on permanent display in Stanley Field Hall.

In May, 1924, Riggs headed southwest in search of a fossil pine forest in the vicinity of Cerro Cuadrado. The first indication of a bosque petrificado, or fossil forest, had come three months earlier, when Riggs was given a fossil pine cone by a country storekeeper midway between Lago Colhué-Huapí and Lago Musters. The specimen had been discovered "60 leagues southward." Riggs was later shown two similar cones at Mazarredo, on the south shore of the Golfo de San Jorge. These were said to have

Dave Walsten

*Author Larry G. Marshall with skulls collected by Riggs from the Santa Cruz Formation. Left is an herbivorous notoungulate; right is a carnivorous marsupial.*

come from "20 leagues to the west." More cones were seen at Jaramillo, about 6 miles north of the Río Deseado and some 40 miles east-southeast of the town of Pico Truncado. These came from "12 leagues to the southward."

Using a bit of elementary triangulation, Riggs calculated the general location of the legendary forest. With the owner of the Jaramillo specimen as guide, the party headed south. After six days of searching, they found the source of the cones, some 60 miles south of Pico Truncado. It was indeed a forest, with petrified stumps still standing and trunks and branches strewn about. Many were of the genera *Araucaria* or *Proaraucaria*, relatives of the Brazilian pine, a living species.

The forest, since designated a national monument by the Argentine government, is recognized as one of the world's two greatest petrified forests, the other being the Petrified Forest in Arizona's Painted Desert National Monument. Riggs was able to make a collection of 250 specimens of fossil cones, twigs, and branches.

In mid-May of 1924 the expedition moved north to escape the rigors of winter. Crossing the Río Negro, Riggs, Abbott, and Sternberg left Patagonia, never to return; they had more than satisfied their objectives. After a break of several months, Riggs was involved in phase II of the expedition, an enterprise that continued until October, 1927. But that's another story—to be recounted in a future *Bulletin*. □

# Volunteers Honored

*Vicki Grigelaitis, of the Department of Education, is coordinator of the Volunteers Program.*

An all-time record of 42,665 total hours were logged by Field Museum's 281 regular volunteers in 1977; an additional 23,854 hours were tallied by 350 Treasures of Tutankhamun volunteers during that exhibition's four-month run. The total hours of the two groups was 66,519—more than twice the volunteer hours for the preceding year.

Volunteers contribute to the operation of each of the Museum's curatorial departments, as well as to the departments of Education and Exhibition, to Planning and Development, the Division of Publications, and other sectors of the Museum's operation; and their areas of expertise are truly impressive. Cataloging, accessioning of specimens, gardening, researching, teaching, photography, technical writing, illustrating, and editing are only a few of the varied services provided on a voluntary basis by this dedicated group. The Museum's indebtedness to them is greater than any expression of gratitude can adequately convey.

On February 1, a buffet reception was held at the Museum to pay tribute to these very special 281 men and women. Leland Webber, Museum president, and William G. Swartchild, Jr., chairman of the Board of Trustees, welcomed the group and presented awards to the volunteers.

**Special recognition:**

John O'Brien (907 hours), Education; assisting in preparation of Harris Extension materials and resources.

Patricia Talbot (828 hours), Geology; compiling Mazon Creek fauna guide.

David Weiss (810.50 hours), Anthropology; curatorial assistance, Asian collections.

Sol Gurewitz (806 hours), Anthropology; photographing artifacts, Oriental collections.

Alice Schneider (800 hours), Anthropology; Chinese rubbings monograph.

Sue Carter-De Vale (780 hours), Anthropology; research, gamelan project.

Anne Leonard (651.25 hours), Anthropology; research, tapacloth project.

James Swartchild (603.50 hours), Anthropology; photographing anthropological collections.

Sol Century (573.25 hours), Anthropology; curatorial assistance, Oriental collections.

**More than 400 hours**

James Burd, Anthropology; cataloguing, accessioning, Asian collections.

Louva Calhoun, Anthropology; illustrating lithic tools for publication.

Peter Gayford, Anthropology; cataloguing, Chinese rubbings research.

Lorna Gonzales, Education; teacher, resource facilitator.

Fleur Hales, Photography Division; photographing specimens and Museum activities.

Claxton Howard, Library; cataloguing.

Malcolm Jones, Education; teacher,

*Beverly Baker, education volunteer, demonstrates artifacts to children in Pawnee earth lodge.*

Vicki Grigelaitis

Vicki Grigelaitis

*Virginia Beatty, volunteer in Botany, prepares liverwort specimens for storage.*

resource facilitator.

LeMoyne Mueller, Anthropology; textile restoration. Zoology; curatorial assistance in Invertebrates.

Ernest Newton, Anthropology; photographing collections.

Carole Schumacher, Geology; cataloguing.

Helen Urban, Anthropology; gamelan restoration.

**More than 300 hours**

Shauna Clark, Anthropology; collection maintenance.

Anne DeVere, Education; teacher, resource facilitator.

Margaret Dreessen, Zoology; organization and labeling of mammal specimens.

Ira Jacknis, Anthropology; textfiche research, Northwest Coast lantern slides, Dorsey Expedition.

Margaret Martling, Botany; cataloguing.

William McCarthy, Museum *Bulletin;* editorial assistance.

Anita Padnos, Education; teacher, resource facilitator.

Sylvia Schueppert, Anthropology; textile restoration.

Llois Stein, Anthropology; cataloguing.

Michael Story, Public Relations; editing, writing.

**1977 VOLUNTEERS**

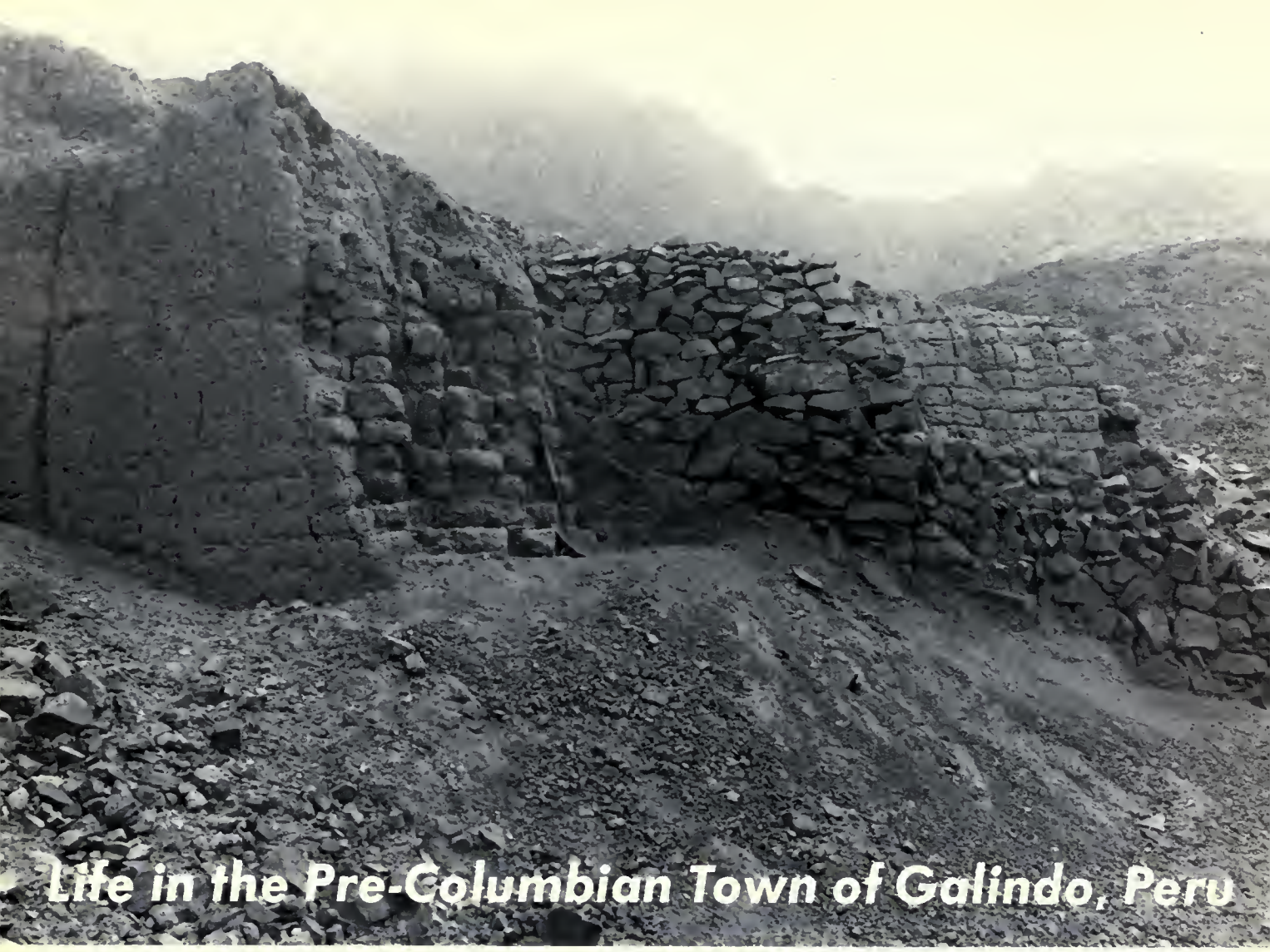
Christine Abiera
Myrna Abrams
Laura Adamski
Bruce Ahlborn
Sydney Allport
John Appel
Carrie Anderson
Cleo Anderson
Dolores Arbanas
Jean Armour
Judy Armstrong
Steve Arnam
Beverly Baker
Margaret Baker
Gwen Barnett
Rae Barnett
Robert Barth
Sanda Bauer
Dodie Baumgarten
John Bayalis
Ann Beverly Bazner
Carol Beatty
Virginia Beatty
Marvin Benjamin
Phoebe Bentley
William Bentley
Leslie Beverly
Riva Blechman
Mary Ann Bloom
Sharon Boemmel
John Botscharow
Idessie Bowens
Hermann Bowersox
Carol Briscoe
Jean Brown
Rose Buchanan
Teddy Buddington
Mary Ann Bulanda
Elizabeth Buntrock
James Burd
Michael Burns
Louva Calhoun
Anna Campoli
Leticia Carlson
Sue Carter-De Vale
Jean Carton
Jean Casey
Sol Century
Karen Chesna
June Chomsky
Mary Clapper
Robert Clark
Shauna Clark
Mark Clausen
Janet Connor
Eugenia Cooke
Collenane Cosey
Diane Coultas
Connie Crane
Velta Cukers
Theresa Dade
Georgette D'Angelo
Eleanor DeKoven
Carol Deutsch
Anne DeVere
Miya Esperanza Diablo
Mariann Diekman
Delores Dobberstein
Carolyn Donovan
Mary Beth Dowell
Margaret Dreessen
Stanley Dvorak
Linda Dybas
Milada Dybas
Sharon Ebbert
Alice Eckley
Bonnie Eiber
Anne Ekman
Karen Elarde
Jeffrey Ellison
Nancy Epping
Lee Erdman
Kathryn Farmer-Margulis
Martha Farwell
Suzanne Faurot
Lee Fefferman
Jo Fitch
Jayne Fitzsimmons
Gerda Frank
Arden Frederick
Nancy Frederick
Melissa Frey
Gary Fritz
Peter Gayford
Rosa Gamarra-Thomson
John Gelder
Patricia Georgouses
Dr. Elizabeth Louise Girardi
Anita Goldberg
Shirley Goldman
Lorna Gonzales
Rochelle Goodsitt
Helen Gornstein
Evelyn Gottlieb
Carol Graczyk
Grace Greaves
Paul Gritis
Theresa Gross-Diaz
Patrick Gulley
Jessye Gunter
Sol Gurewitz
Fleur Hales
Michael Hall
Bernice Harris
Shirley Hattis
Gail Hathaway
Audrey Hiller
Rose Horner
Claxton Howard
Miranda Howard
Ruth Howard
David Humbard
Julie Hurvis
Adrienne Hurwitz
Lucinda Hutchison
Diane Hutchinson
Ellen Hyndman
James Jack
Ira Jacknis
Penny Jacobs
Patricia Jacobssen
Malcolm Jones
Julia Jordan
Dorothy Karall
Ruthe Karlin
Adria Katz
Shirley Kennedy
Lisa Kent
Marjorie King
John Kolar
Larry Kolczak
Anne Koopman
Eva Kopel
Katherine Krueger
Roberta Laffey
Anita Landess
Hildy Lane
Carol Landow
Dorothy Leghorn
Anne Leonard
Elizabeth Lilly
Carol Link
Margaret Litten
Susan Lynch
Edna MacQuilkin
Russell Maheras
Judy Main
Catherine Majeske
Gabby Margo
Gretchen Martin
Margaret Martling
Martha Mather
Geri Matsushita
Joyce Matuszewich
Melba Mayo
William McCarthy
Mark McCollam
Chloe McKeever
Cecily McNeil
Withrow Meeker
Thomas Menchaca
Margot Merrick
Marilyn Miller
Martha Mills
Grace Millman
Sharon Moehling
Carolyn Moore
LeMoyne Mueller
Anne Murphy
Mary Naunton
JoAnn Nelson
John Ben Nelson
Mary Nelson
Nancy Nelson
Louise Neuert
Natalie Newberger
Ernest Newton
Herta Newton
Allan Niederman
Joyce Niederman
Suzanne Niven
Mary Eileen Noonan
Bernice Nordenberg
Janis O'Boye
John O'Brien
Diane O'Neil
Joan Opila
Gary Ossewaarde
China Oughton
Anita Padnos
Raymond Parker
Susan Parker
Sally Parsons
Frank Paulo
Christine Pavel
Elizabeth Peacock
Anna Pearman-Daugerdas
Hazel Pensock
Mary Ann Peruchini
Wilma Pesavento
Lorraine Peterson
Kathleen Picken
David Poster
Elizabeth Rada
Col. M. E. Rada
Ruth Reinhold
Sheila Reynolds
Yvonne Robins
William Roder
Barbara Roob
Sarah Rosenbloom
Marie Rosenthal
Anne Ross
Dennis Roth
Helen Ruch
Lenore Sarasan
Maija Sedzielarz
Theresa Schaefer
Margaret Schaffner
Tim Schalk
Joel Schenk
Alice Schneider
Sylvia Schueppert
Julia Schultz
Carole Schumacher
Sandy Schweitzer
Beverly Scott
Louise Searle
Laura Seidman
Ann Shanower
Louise Sherman
Judy Sherry
James Skorcz
Eleanor Skydell
Catherine Smallwood
Janet Sobesky
Irene Spensley
Tim Stark
Llois Stein
Lorain Stephens
Lucille Stern
Dorothy Stevenson
Joann Stevenson
John Stine
Michael Story
Susan Streich
Beatrice Swartchild
James Swartchild
Julia Szymczyk
Patricia Talbot
Jane Thain
Clare Tomaschoff
Dana Treister
Harold Tsunehara
Edith Turkington
Lynn Turner
Helen Urban
Karen Urnezis
Judith Valentine
Barbara Vear
Don Virgil
Harold Voris
Kim Waldron
Sandra Wantuch
Harold Waterman
Suzanne Webb
David Weiss
Fred Werner
LaDonna Whitmer
Reeva Wolfson
Lynn Zeger

Photo by H. H. Bennett, courtesy H. H. Bennett Studio, Wisconsin Dells, Wis.

*The Devil's Doorway, on the southeast bluff above Devil's Lake, Wisconsin. The photo at left was taken in 1872, that on the right a century later—1972. The earlier photo was the work of H. H. Bennett (1843-1908), a well known landscape photographer. His home and studio in Wisconsin Dells (then called Kilbourn) is now a museum. The 1872 photo was made on a 4 x 5 glass plate negative. The 1972 photo, taken by a Field Museum volunteer, was made on 4 x 5 film. The Devil's Doorway consists of Baraboo quartzite, an extremely*

Courtesy Actinics

*hard metamorphosed sandstone that weathers very slowly. Since Bennett took his photo, climbers have apparently titled the large boulder above the doorway; a metal pin (not visible here) for climbers' ropes has also been hammered into the rock. The Baraboo field trips for Field Museum members have annually visited the Devil's Doorway site, some 160 miles northwest of Chicago.*



# Life in the Pre-Columbian Town of Galindo, Peru

*Massive stone and adobe wall at Galindo. This wall is more than six feet thick. A central stone core was faced with thick skins of adobe brick. The adobe facing still stands to the left, but has collapsed on the right, exposing the core. This wall ran across the base of a hillside separating a lower class hillside residential area from the remainder of the settlement below.*

**By Garth Bawden**

*Photos courtesy of the author*

THE NORTHERN COASTAL DESERT OF PERU is one of the most arid regions of the world. In contrast, the numerous small river valleys which cross this desert constitute rich irrigated oases where numerous crops are grown and where fairly dense population is possible. Just as this situation exists today, so it did in the time before the coming of the Spanish *conquistadores* to Peru. During that period a sequence of rich indigenous states flourished in the northern coastal valleys. Among them was the Moche state (200-800 A.D.), the subject of this study. This state was centered in the Moche River Valley, where two of its major settlements were located. The largest of these contained the Huaca del Sol (illustrated in the March 1977 *Bulletin*). This huge settlement constituted the focal point of the Moche state for much of its existence. However, around 600 A.D. the Huaca del Sol was abandoned and the capital removed much farther north up the coast. This dramatic reorganization apparently occurred as a response to both internal disruption and foreign threat; indeed, almost all of the Moche territories south of the Moche Valley were lost at this time. A somewhat smaller, less elaborate but highly complex settlement remained as the center of Moche rule in the valley. This settlement, Galindo, formed the focus for a two-year archaeological investigation that I directed from 1972 to 1974.

---

*Garth Bawden is on the curatorial staff of Peabody Museum of Archaeology and Ethnology, Cambridge, Mass.*

Galindo is a 6-square-kilometer city situated at the junction of the Andes foothills and the coastal plain of the Rio Moche, about 16 kilometers (10 miles) from the sea. The city spreads over the desert that flanks the narrow, intensively cultivated river valley. Such a location was common for the larger pre-Spanish settlements of Peru and allowed easy access to the fields without occupying irrigable ground. Agricultural productivity, essential for the existence of the state, was thus maximized. Because of the extreme dryness of the desert climate, the preservation at Galindo is excellent, and we find that stone and mud-brick structures used for domestic housing, city government, religion, storage and industry are largely intact. Not only architecture remains; in the kitchens of domestic homes, mud-brick hearths still contain food refuse from the last meals cooked in them. Corncobs, shell, llama and fish bone, peanuts, and peppers attest to the varied diet of the inhabitants. Likewise, literally hundreds of thousands of pottery fragments thickly cover the floors of Galindo buildings. These are fragments not only of cooking and storage vessels but also of the fine painted pottery that served as a major vehicle for Moche artistic expression.

Pottery vessels, known as stirrup-spout jars because of their distinctive shape, are the best known remains of Moche material culture. They appear in the display cases of all major museums and represent a high-water mark in indigenous American art. Like Greek vases, these Moche vessels are adorned with many representations of daily activities, revealing much about the life of the people that would otherwise be unknown.

The lifeways represented by these rich remains were varied and complex. Galindo, the equivalent of a modern provincial capital, contained a large number of public administrative and religious buildings as well as an extensive residential area and industrial sites. In fact, Galindo represents the Moche equivalent of the modern local center not only in the architecture of its structures but in the way in which these are arranged. Just as in modern cities the government center and main religious buildings have privileged locations, so do they at Balindo. *Cercaduras*—large complexes of walled compounds containing impressive series of terraced rooms—represent the administrative foci of the city. These structures stand in the heart of the city on high ridges where they are in clear view of the residential areas. Through their physical prominence they clearly manifest the authority which radiated from them to the whole Moche Valley.

The religious center of Galindo is similarly set apart from the rest of the settlement in a prominent, yet secluded, location. On a naturally formed terrace stand three platform mounds. These structures, which consist of square platforms supporting superstructures approached by ramps, are small relatives of the huge Huaca del Sol at Moche. They represent the focus of religious activities around which the daily activities of Moche life centered—much as our traditional Western civilization centered around its great cathedrals and churches.

Another important architectural structure present at Galindo also has its parallels in the city planning of other civilizations. A huge complex including a platform and four walled compounds stands near the religious platforms. This elaborate structure was probably the palace of Galindo's chief ruler. Although today the all-pervading desert has imbued the palace with its own somber texture and color, when in use it embodied the authority and magnificence of a centralized state. The pyramid, with its centuries of importance as the architectural center of Moche religion and government, is incorporated into a palace complex, lending the weight of traditional symbolism to the residence and person of the ruler.

Moreover, the plastered walls of the palace compounds were originally bright with color. Frescoed figures, representing heroes and divinities from Moche

*Stirrup-spout jar from upper class home at Galindo. Such vessels often bore painted depictions of religious ceremonies and mythological creatures.*

*Pottery figurines recovered from residences. Female figure on right holds a rattle. Two figures on left wear typical Moche headdresses, while one also plays musical instrument. Small figurine second from right represents a monkey. Such figurines were common in Galindo homes of all classes and were manufactured in a pottery workshop discovered at the settlement.*

mythology, were painted around the inside walls of the main entrance compound — awing the visitor with their dramatically contrasting blue, red, and yellow forms.

From this entry compound ramps led to elevated walkways on the compound walls. Thus, access was gained in a roundabout fashion to the area of the pyramid itself — the most exclusive portion of the whole complex. It was this area which probably contained the residence of the ruler and which marks the place of supreme authority at Galindo.

Within all of the major architectural structures concerned with state authority—be they religious or secular—may be seen the exact locations where such authority was exercised. Small daises, often approached by ramps or steps, stand in the most elaborately formal parts of the structures. The activities which centered on these daises are depicted on the stirrup-spout vessels: rulers seated in victorious splendor, receiving homage from their defeated foes; religious ceremonies being performed before personages seated on a dais; resplendently garbed individuals apparently dispensing justice and exercising administrative authority. Thus we can recreate from the ancient painted vessels and crumbling architecture the life-and-death events which once centered around them and imagine the complex governmental apparatus of a refined civilization carrying out the procedures which ensured the orderly existence of Moche society.

Moche society at Galindo was highly structured. A population numbering in the tens of thousands was divided into strictly ordered classes, each with its own functions and responsibilities. This social division was carried to the extent of separating the residential areas of the different groups. Thus the largest, most elaborate residential structures are at a distance from those of the

*Aerial view of Galindo, showing a small segment of the upper class residential architecture which spreads across the plain.* ►

majority of the populace. Extensive well built residences with large kitchens, benched living rooms, and numerous storerooms spread over the otherwise empty ground near the *cercaduras*. These structures were the residences of a ruling elite — those individuals who worked in the nearby centers and controlled the administrative machinery.

A much larger area of residential structures, not as elaborate as these, extends across the plain adjacent to the cultivated valley bottom. Here lived the upper classes of Galindo. In homes sharing the same plan and internal functional components, these people lived in well constructed dwellings which still vividly portray the nature of domestic life at Galindo more than a thousand years ago.

The typical dwellinghouse of the middle class Galindo denizen was of four or five rooms contained within strong stone-wall bases, upon which stood cane superstructure. Roofing was also of cane. Abundant remains of this construction include not only the stone walls but wooden roof posts and fallen cane roofing, which now lies on the floors.

Dwellings typically had a single entrance, opening into a large kitchen. These kitchens still contain the remains of the food prepared there long ago. The refuse surrounded hearths, which were set into the ground or sometimes into a wall. Living rooms, adjoining the kitchens, contained stone benches which lined a central sunken patio. While the benches were roofed with cane supported on wooden posts, the central floor remained open to the sky. Such an arrangement allowed maximum ventilation, an important feature in this tropical climate. Our excavation clearly showed that these benched rooms served as the foci of general household functions. The presence of copper needles, ceramic and stone spindle whorls, and wooden shuttles attests to a highly developed technique of cloth production. A variety of well made, painted pottery vessels, including small figurines, usually lying on the bench surfaces, suggests that this central household space contained the occupants' most elaborate domestic possessions. In much the same way, modern families often place their prized domestic ornaments in their living rooms.

Leading from the living room of the typical Galindo home are one or two small storage rooms, which invariably contain large broken pottery jars. At times, corncobs and fruit seeds are also found with these vessels, suggesting that the rooms were primarily used for domestic food storage. The well preserved domestic remains of Galindo bring the everyday lifestyle of the average inhabitant far more vividly alive than do the pyramids and large compound complexes with their remote formal grandeur. In the abandoned hearths with cooking utensils and food scraps still lying around them, in the partially completed textiles, small figurines, and

*Elaborate domestic residence. The room on the left was the kitchen, and contains four large grinding stones and much refuse. Such structures are numerous and represent the well constructed homes of the upper class at Galindo.*

*Galindo "florero," or flaring bowl. These vessels were often elaborately decorated and stood on tall pedestal bases.*

personal and household ornaments, the visitor can perceive the domestic routine of ordinary human families responding to the normal stresses and needs of everyday life in ways remarkably similar to our own. At this level archaeological investigation loses its scientific aura and becomes a means of understanding the continuity and universality of human behavior.

Another aspect of domestic residence at Galindo reflects the darker side of urban life. Along a hillside which flanks the main city spreads an extensive area of small, poorly constructed dwellings. These houses stand on crude terraces cut out of the hillside and rise tier upon tier up the steep slope in a manner reminiscent of the *barrios*, or shantyvilles, which fringe modern South American cities. This area represents the segregated sector of Galindo which housed the lower classes. The rooms which make up these lower-class houses are of the same functional nature as those of the more elaborate structures. However, they are smaller and the rigid pattern of the latter is lost. Likewise, their contents are of lower quality, with pottery vessels being mainly utilitarian, and painted varieties, when present, being not as well constructed and not so elaborately decorated.

The segregation of the area of lower-class domestic houses is emphasized by a large wall separating it from the rest of the settlement. This wall, constructed of a multilayered core of adobe bricks faced with plaster and standing on a massive stone base, runs along the entire length of the hillside which contains the poorer housing. In places it still exceeds two and a half meters (about 8 feet) in height. Only a few openings give access to the plain and the settlement proper.

Such an elaborate barrier between domestic architectural types surely indicates the presence of highly developed and strictly enforced social stratification. Those individuals dwelling on the plain apparently had access to roomier houses and a higher quantity of luxury goods. Likewise, they lived near a vital water supply which, in the form of a canal, flowed adjacent to the plain, separating it from the agricultural land in the valley bottom. Moreover, various manufacturing and food distributing sites were also situated within the higher class residential areas and were operated by their occupants.

The hillside-dwellers were thus cut off from direct access to these favored areas. They were forced to walk

*Thronelike stone dais approached by lateral and frontal ramps. These structures are often depicted in Moche art and represent the locations from which dignitaries supervised administrative and religious functions.*

considerable distances from their homes to the sites of agricultural cultivation, food distribution, and manufacture. In addition, all of the food and water consumed by the lower class inhabitants of Galindo had to be carried considerable distances up the hillslopes to their homes.

Thus we can see that social division and separation is not a recent phenomenon. Nor is it confined to Western civilization with its culmination in the industrial revolution and the associated rise of great modern cities. This American city had developed such a system of social distance and differential privilege many centuries before the Spaniards set foot in the New World.

The manufacturing sites and food distribution centers previously mentioned were important factors in the efficient working of this complex settlement. Two production sites were discovered at Galindo, one for making pottery, the other for fashioning copper ornaments.

The pottery workshop, the first of its kind yet identified for Moche culture, clearly revealed the technological process by which ceramic vessels were produced. The vessels were shaped in clay molds, then placed in a firing pit. This shallow depression in the ground was then packed with fuel, mainly consisting of llama manure and small pieces of cane. After the ignition of the fuel, the pit was covered by a thin layer of earth, which, by preventing easy oxygen flow to the burning materials, caused a smoldering, smoky combustion in which the pottery vessels were fired until hard. This process resulted in the characteristic dark brown interior color of Moche utilitarian pottery at Galindo.

Adjoining the pottery workshop is a large rectangular enclosure, which contains abundant evidence of llama, the pack animal of the Andes. These animals were evidently used to transport the clays used in the workshop from their sources near the Moche River, possibly several miles away. Moreover, the finding of several

*Excavated section of upper-class residence, showing the elaborate architectural construction. Steps connect a livingroom, on the higher level, with storage rooms on the right. Such stone or mud brick-lined storage bins were probably used in the redistribution of subsistence commodities at Galindo.*

*The Galindo palace complex. Large walled compounds surround a badly damaged platform. The interior walls of the compounds were originally brightly painted. In the background lies the cultivated valley of the Rio Moche. This is separated from the settlement by a canal marked by raised banks which cross this view just behind the palace complex.*

fragments of non-Moche pottery in this area may well mark the existence of a ceramic trading system between Galindo and neighboring regions.

Most of the vessels manufactured in the pottery workshop were used for cooking and storage. However, molds of small figurines were also in the workshop, evidence probably of the use of these objects as common household ornaments. No fine stirrup-spout vessels were made at this workshop, which suggests that this ceramic form possessed higher value and was manufactured at a different, higher-status location. Such a specialization is reminiscent of the various craft guilds of Medieval Europe, where the items created by each artisan were determined by clearly specified customs and regulations.

A second center at Galindo fashioned copper ornaments. Still remaining are the stone anvils, hammerstones, and polishing stones used by the craftsman. Surrounding these tools were numerous copper fragments ranging in size from small slivers to large unshaped pieces, the waste from ornamental copper production. Several small round discs, each with a perforation, gives evidence of at least one type of ornament produced in this place. Elaborate gold and copper collars fashioned from such small discs and held together by wire have been discovered in rich Moche burials. Moreover, they are seen on painted pottery, worn by persons of obviously high status.

Archaeological investigation at Galindo also reveals the presence of food distribution centers. These centers, which are usually attached to upper-class residential complexes consist of several large rooms lined with carefully constructed mud-brick storage bins. In these bins lie the remains of crops grown in the nearby valley, and shells brought from the coast, 16 kilometers distant. The materials represented by these remains were transported to the distribution centers by llama. Llama corrals, in which these animals were penned when not working, adjoin all such complexes.

Thus, Galindo offers clear insight into the complex workings of a pre-Columbian city. A small elite, headed by a paramount ruler, governed the settlement and its valley. This secular administration was supported by a time-revered religious system which provided the ideological base for Moche society. Beneath these integrating bodies lay an ordered society strictly divided on the basis of class and wealth. The upper classes managed craft and marketing functions, while the lower classes, segregated in their hillside *barrio,* provided the labor force for these operations. Art and architecture, metalworking, and ceramic technology were highly refined, Moche ceramic and metal art rivaling in quality similar forms anywhere in the world. Long-distance transportation and trade were common, and the technology which created the life-giving irrigation system exceeds in efficiency any such system used in present-day Peru.

Galindo clearly shows that pre-Columbian Peru had an urban development, similar in many basic elements to that of present-day America. While the form and expression of these elements are specific to each culture, their fundamental roles and relationships and the way in which they affect the everyday life of the members of society vary surprisingly little through time.

# *The Conservation of a Woven Hat Cover*

**By Christine Danziger and Jim Hanson**

THE COVER TO A CEREMONIAL HAT of the Haida Indians, of British Columbia, has been partially restored through the efforts of a Department of Anthropology volunteer in conservation. Shauna Clark has stabilized and restored the weave of the cover for exhibition in the "Basketry of the Northwest Coast Indians" exhibit in Hall 27.

Both the hat and the cover were collected for the Museum in 1901. The hat itself is woven of light brown spruce root and decorated with the figure of a Wasco, a Haida mythological creature, in red and black. The hat cover is done in a mat weave of soft bast, or inner bark, probably of cedar. The chestnut brown of the cover is considerably darker than that of any other specimen of this material in the Museum's collection, probably because it was dyed.

Unlike the hat, which had been on exhibit in Hall 10, the damaged cover was in storage for many years. When it was removed in preparation for the current basketry exhibit, it bore evidence of attempted restoration, in which the soft, delicate bast weave had been partially repaired with hard bamboo slivers, painted to match the color of the bast. The hard bamboo had deformed the shape of the cover and caused more breakage by forcing the warp and weft apart.

To restore the cover for exhibition, it was first cleaned and its bamboo sticks removed. The problem then was to find a material to replace the broken bast fibers. The replacement material had to be compatible with the physical and chemical properties of the bast, and be thin and pliable so as not to disturb the cover's textile structure. In accordance with the Museum's conservation policy, the material would not be applied with the idea of completely restoring missing parts, but merely to stabilize and preserve the specimen. The material would not be an exact duplication of the original fiber; thus, the portion restored could always be distinguished from the original material.

After some research, it was concluded that paper would best satisfy the restoration requirements; the material finally chosen was a wet-strength mulberry silk tissue, for this paper is pliable, extremely thin, strong, acid-free, and also receptive to paint.

The task of restoration required a craftsman skilled in weaving and textile technology, and such a person was found in Shauna Clark. She has a degree in fine arts and weaving from Illinois State University and studied for several months on a fellowship under Yoshi Takahashi, a noted Japanese watercolorist.

Over a period of many weeks, she cut strips of tissue of precisely the right dimension and painstakingly painted them, using watercolors that matched the dark brown of the hat cover. The strips were folded in half, to match the width of the original fibers, threaded through a blunt-end needle, and then run into the weave of the cover to replace the missing fibers.

The time-consuming task demanded the technical skill of a textile expert, the aesthetic sensibility of an artist, and the patience of an experienced craftsman; and it was essential that the restoration be effected in such a manner that the artifact not be remade or altered in any way. The results of Shauna Clark's work are now permanently visible in this exquisitely restored piece.

*Volunteer Shauna Clark with Haida hat and hat cover*

Fleur Hales

---

*Christine Danziger is conservator, Department of Anthropology; Jim Hanson is a member of the department's clerical staff.*

# *Shadow Puppet Performances with Musical Score for Gamelan*

Traditional Javanese shadow plays, based on ancient legends, can be gigantic epics which continue for hundreds of performances. The "actors" are puppets, whose images are projected as shadows on a screen.

"Through Cloud and Eclipse," to be performed at Field Museum in Hall K, on March 31, April 1 and 2, is part I of such an epic, and lasts for one hour. The text was written by Robert Moran and Donald Case, internationally known composer and puppet creator, respectively. The play is about the hero Hammi's quest for the knowledge of life and his encounters with a mysterious cloud, two giants, and a magical tree. It is a multimedia presentation, combining rear screen projection, taped sound, and live music performed on Field Museum's gamelan — a Javanese orchestral ensemble.

The musical score, composed by Robert Moran, will have its premier performance on opening night, March 31. For each of the performances, the gamelan will be performed by Northwestern University Contemporary Music Ensemble. The program is cosponsored by Northwestern University and Field Museum. The size of the audience for each performance is limited to 150.

For tickets, please send coupon below, together with check and self-addressed, stamped envelope. Tickets will be mailed upon receipt of check. Refunds will be made only if the performance(s) are sold out. Mail to Department of Education, Field Museum, Roosevelt Road at Lake Shore Drive, Chicago, Il. 60605.

*"Through Cloud and Eclipse"*
**Shadow Puppet Performances**

Name _____
last first

Address _____
street

_____
city state zip

Phone _____ _____
daytime evening

I am a member ☐ nonmember ☐

Limit of 6 tickets per order.

Member: $1.00; Nonmember: $2.50

Please indicate 1st, 2nd, and 3rd choices.

| Friday | Saturday | Sunday |
|---|---|---|
| Mar. 31 | April 1 | April 2 |
| 5:30 p.m. ☐ | 11 a.m. ☐ | 11 a.m. ☐ |
| 7:30 p.m. ☐ | 1 p.m. ☐ | 1 p.m. ☐ |
| | 3 p.m. ☐ | 3 p.m. ☐ |

Amount of check enclosed $_____

# OUR ENVIRONMENT

### Octopus Death Takes a Holiday

An accidental discovery following surgery on female octopuses may be the first time science has delayed the process of dying. Jerome Wodinsky, a Brandeis University psychologist, was practicing surgery on female octopuses who normally die after laying eggs, in preparation for a study of the behavior of the male octopus after its sex glands have been removed. The females, which were put to sleep with alcohol and their legs weighted down with salt water, had two glands between the eyes removed. These so-called "optic" glands function like the pituitary glands of most land animals, controlling production of hormones, including sex and reproduction After the glands were removed the females doubled their lifespan as well as their weight. Wodinsky thinks this clue to possible hormone control of aging and death may provide a useful tool for studying the aging process, and controlling of population size of one of the largest predators in the oceans.

### Salmonella Claims Sparrows

A die-off of house sparrows in Fergus Falls, Minn., has been traced to *Salmonella* infection. A common wintertime problem in northern states, *Salmonella* was diagnosed in a sampling of dead sparrows by the National Fish and Wildlife Health Laboratory in Madison, Wis.

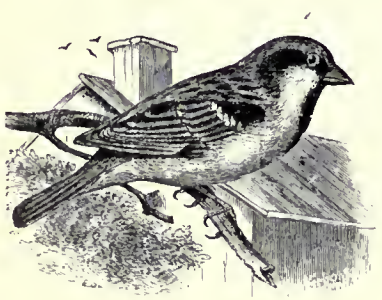
The disease can occur in wintertime when birds concentrate around backyard feeders, the service says. One or more carriers of the organism may—sooner or later—join feeding birds and the disease then spreads from bird to bird. Bird droppings and seed remains that accumulate on feeders and the surrounding ground create unsanitary conditions to encourage the disease when carriers are present.

The infection can also spread to other animals and possibly man, the service warns. Similar losses of house sparrows have previously occurred in other areas, including Iowa, Wisconsin, West Virginia, New York, Connecticut, and Ontario, Canada.

Care should be exercised in handling dead birds, or any dead animal for that matter. If dead birds are picked up, basic precautions should be exercised. The following clean-up procedures are suggested:

- Wear gloves when handling dead animals or droppings.
- Wash hands in soap and water immediately after handling specimens.
- Clean up the feeder and feeding area. Don't let debris and droppings accumulate.

Most of the time *Salmonella* infection tends to remain in one species. However, the disease will sometimes build up enough to infect everything in the area, including goldfinches, grosbeaks, and other bird species.



### Cattail: A Miracle Plant?

University of Minnesota researchers are studying a lowly swamp plant that could someday heat homes, provide food for people and livestock, clean polluted water and even provide writing paper. That's the potential seen for the cattail, a wetlands reed that one naturalist has called the "supermarket of the swamp."

The university is currently one of two institutions cultivating cattails for research. The other managed cattail study is being conducted in Czechoslovakia.

"The main reason for choosing the cattail for research is that the plant is so productive," says Douglas Pratt, head of Minnesota's botany department.

Pratt says cattails make a natural fuel, can be pulverized into a papyrus-like paper, and are naturally rich in starches — a perfect animal feed. They grow profusely in small areas, producing more total growth per acre than most other plants and they have a natural ability to regenerate through a system of underground shoots, or rhizomes.

Cattails seem to have all the advantages in nature's battle for survival. Where the ground is wet, cattails will grow in wild abandon, developing more biomass than most domestic crops.

Biomass is the total material making up the plant. Cattails annually produce 15 to 20 tons of biomass per acre, compared to about one ton produced annually by an acre of aspen forest.

One reason for bountiful growth is the plant's ability to grow steadily from the first spring thaw to the first winter frost.

A farmer can cut a six-foot swath through a field of cattails, only to find the plants on the sides of the swath regenerating the cleared area immediately. Cattails send out underground stems for approximately three feet, making any clear area a nursery for new plants.

On top of all that, cattail growth is stimulated by the presence of nitrogen and phosphate in their watery environment. Both chemicals cause pollution in lakes and rivers, but cattails absorb them and use them as nutrients.

"It can do a fairly good job of cleaning up sewage drained into a wetland," Pratt said of the swampland reed.

Dried and ignited, cattails burn as fast as paper. Recently, however, scientists have developed a way of compressing cattails into slower burning briquets. Treatment of the plant to produce liquid and gaseous fuels is also being studied, Pratt said.

Finally, the cattail could potentially produce suitable flour for human consumption, Pratt believes. Cattail bread sounds a bit far fetched, but is plausible if technology could be developed to economically harvest the root systems of the plants.

# *March & April at Field Museum*

*(March 15 through April 15)*

### New Exhibits

**Chinese Folk Art**—opens April 6. A special temporary exhibit of approximately 150 utilitarian and symbolic objects dating from the mid-15th to the 20th century. Each artifact expresses the underlying characteristic of its period. Included in the exhibit are bamboo furniture, woodblock prints, textiles, tile engravings, folk paintings, baskets, paper crafts, statues, and lacquered leathers and metal work. On loan from the University of Hawaii, this exhibit is dedicated to Chinese-Americans in celebration of the U.S. Bicentennial. Hall 27. Through July 5.

### New Programs

**Ayer Illustrated Lecture Series**—Saturdays, through April 29, at 2:30 p.m. Enjoy an adventurous but relaxed afternoon touring the world while comfortably seated in the museum's Simpson Theatre, ground floor west. Doors open at 1:45 p.m. A limited number of reserved seats are available for Members on days of the lectures until 2:25 p.m.

| | |
|---|---|
| March 18 | *The Mediterranean*<br>by Fred Bellinger |
| March 25 | *Japan*<br>by Ken Wolfgang |

*Chinese Folk Arts exhibit opens April 6*

**Peru's Golden Treasures.** A dazzling collection of 225 pre-Columbian gold artifacts, on loan from the Museo Oro del Peru, Lima, comprises the largest collection of its kind ever shown in the United States. Augmenting the Museo Oro del Peru pieces, which survived the Spanish conquest of Peru in 1532, are more than 50 antiquities from Field Museum's own collections and from those of the Peabody Museum at Harvard. Hall 26. Through May 21.

| | |
|---|---|
| April 1 | *Iran*<br>by Chris Borden |
| April 8 | *Sailing Adventures*<br>by Captain Irving Johnson |
| April 15 | *Portraits of Brazil*<br>by Curtis Nagle |

*Calendar continued on back cover*

# *March & April at Field Museum*

*(CALENDAR continued from inside back cover)*

**Evening Adult Education Courses, Spring Series—** begins April 18, 19, 20. Natural history and anthropology noncredit courses are offered to persons 18 and over. Watch your mailbox for a special *Adult Education Courses* flyer, which has further details. Because class enrollment is limited, early registration is recommended.

### Continuing Exhibits

**Field Museum Gamelan.** Field Museum's 130-year-old Javanese gamelan, an ensemble of 24 fine bronze and wood musical instruments, has been completely restored for exhibition. It is the oldest and perhaps finest gamelan outside Indonesia. Hall K, ground floor.

**Pawnee Earth Lodge.** This permanent exhibit, in Hall 5, is a traditional Pawnee earth lodge—the home and ceremonial center of Pawnee Indians as it existed in the mid-1800s. Daily programs provide opportunities to learn about Pawnee culture. Public program hours: Monday through Friday, 1:15 p.m.; weekends, 11 a.m. and 1:15 p.m. Tickets may be obtained 15 minutes prior to the program at the north information booth. Programs limited to 30 people.

**The Place for Wonder.** This gallery provides a place to handle, sort, and compare artifacts and specimens. Weekdays, 1 p.m. to 3 p.m.; weekends, 10 a.m. to noon and 1 p.m. to 3 p.m. Ground floor, near elevator.

**Male and Female: Anthropology Game.** The exhibit where visitors become anthropologists. Discover that economic and social roles of the sexes are not universally the same. Ground floor, near elevator.

### Continuing Programs

**Discovering the Moche—**Fridays and Sundays, through May 21, at 11 a.m. and 2 p.m. Short documentary film interpretes the symbolism in pottery designs made by Peruvians 1,000 years before the Incas. Shown in conjunction with the *Peru's Golden Treasures* exhibit. Simpson Theatre, ground floor west.

**Potato Planters—**Fridays and Sundays, through May 21, at 11 a.m. and 2 p.m. Short documentary film surveys the modern Peruvian Aymara Indians who continue to live like their pre-Columbian ancestors. Shown in conjunction with the *Peru's Golden Treasures* exhibit. Simpson Theatre, ground floor west.

**Lords of the Labyrinth—**Saturdays, through May 20, at 11 a.m. Newly released BBC-TV production features new developments in recent archaeological fieldwork by Field Museum anthropologists on the north coast of Peru. Shown in conjunction with the *Peru's Golden Treasures* exhibit. Simpson Theatre, ground floor west.

**Spring Journey for Children: Exploring the Ancient Andes—**through May 31. Free self-guided *Journey* leads children and families through museum exhibits to learn about the lifestyles of ancient Andean cultures. *Journey* pamphlets are available at the information booth, main floor.

**On Your Own at Field Musem.** Self-guided tour booklets, adult- and family-oriented, available for 25c each at entrance to the Museum Shop, main floor north.

**Weekend Discovery Programs.** Guided tours, demonstrations, and participatory activities. Every Saturday and Sunday, 10 a.m. to 3 p.m.

**The Ancient Art of Weaving.** Demonstrations every Monday, Wednesday, and Friday, 10 a.m. to noon. South Lounge, 2nd floor.

**Audio Information System.** The museum's newly installed audio system, Uniguide, enables visitors of all ages to visit selected exhibits in any sequence. Audio receivers and maps available for $1.25 per person, $3.75 for a family of up to five at the entrance to the Museum Shop, main floor north.

### March and April Hours

**The Museum Opens** daily at 9 a.m. and closes 5 p.m. every day except Friday. On Fridays, the museum is open to 9 p.m.

**The Museum Library** is open weekdays 9 a.m. to 4 p.m. Obtain a pass at reception desk, main floor.

**Museum telephone:** (312) 922-9410.

April
1978

Field Museum of Natural History Bulletin

# FOLK ART IN CHINA

Members' Preview April 5

10 a.m. to 9 p.m.

**Field Museum of Natural History Bulletin**

April 1978
Vol. 49, No. 4

*Editor/Designer:* **David M. Walsten**
*Production:* **Oscar Anderson**
*Calendar:* **Nika Semkoff Levi-Setti**
*Staff photographer:* **Ron Testa**

**Field Museum of Natural History**
Founded 1893

*President and Director:* **E. Leland Webber**

BOARD OF TRUSTEES

William G. Swartchild, Jr., *chairman*
Mrs. T. Stanton Armour
George R. Baker
Robert O. Bass
Gordon Bent
Harry O. Bercher
Bowen Blair
Stanton R. Cook
O.C. Davis
William R. Dickinson, Jr.
Thomas E. Donnelley II
Marshall Field
Nicholas Galitzine
Paul W. Goodrich
Hugo J. Melvoin
William H. Mitchell
Charles F. Murphy, Jr.
James J. O'Connor
James H. Ransom
Mrs. Joseph E. Rich
John S. Runnells
William L. Searle
Edward Byron Smith
Robert H. Strotz
John W. Sullivan
Edward R. Telling
Mrs. Theodore D. Tieken
E. Leland Webber
Julian B. Wilkins
Blaine J. Yarrington

LIFE TRUSTEES

William McCormick Blair
Joseph N. Field
Clifford C. Gregg
Samuel Insull, Jr.
William V. Kahler
Remick McDowell
J. Roscoe Miller
James L. Palmer
John T. Pirie, Jr.
Donald Richards
John M. Simpson
J. Howard Wood

CONTENTS

3 **Field Briefs**

4 **Virunga: Or Whatever Happened to Albert National Park?**
*By Burt A. Ovrut and Susan Ovrut*

10 **Our Environment**

12 **Anthropology Game: Male or Female?**
*By Michael Story, assistant in Public Relations*

14 **Folk Art in China**
New Exhibit Opens April 6

16 **Prehistoric Missionaries in East Central Illinois**
*By Thomas J. Riley and Gary A. Apfelstadt*

22 **Thumbelina: House Guest in Miniature**
*By Ivan Barker*

23 **Dayflowers**
*By Robert Faden, assistant curator of botany*

26 **Quetico Canoe Trip for Members**

27 **April and May at Field Museum**
Calendar of Coming Events

COVER

Chinese paper cutout, twentieth century. Reproduced exact size. This cutout, made with a knife, represents a Chinese lantern, a popular cutout subject. A variety of cutouts may be seen in the new exhibit, "Folk Art in China," open to the public in Hall 27 on April 6, closing July 5. Many art forms and media are represented in the show. For further information see p. 14.

The cover cutout is from the collection of Carol Link, a Field Museum volunteer and a specialist in Far Eastern art.

*Field Museum of Natural History Bulletin* is published monthly, except combined July/August issue, by Field Museum of Natural History, Roosevelt Road at Lake Shore Drive, Chicago, Il. 60605. Subscriptions: $6 a year; $3 a year for schools. Museum membership includes *Bulletin* subscription. Opinions expressed by authors are their own and do not necessarily reflect the policy of Field Museum. Unsolicited manuscripts are welcome. Postmaster: Please send form 3579 to Field Museum of Natural History, Roosevelt Road at Lake Shore Drive, Chicago, Il. 60605. ISSN: 0015-0703.

*Field Museum volunteers Hermann C. Bowersox and William E. McCarthy assisted in the editorial preparation of this issue.*

# FIELD BRIEFS

*PERU'S GOLDEN TREASURES is on view in Hall 26 through May 21. The widely acclaimed exhibit features 225 pre-Columbian gold artifacts on loan from the Museo Oro del Peru, of Lima, Peru. The exhibit was designed by Don Skinner, Department of Exhibition.*

### Members' Nights

Mark your calendar now for *Members' Night!* This year, because of the great, recent increase in Field Museum's membership rolls (nearly tripled in 1977), Members' Night will take place on four successive dates: May 15, 16, 17, and 18 (Monday through Thursday) in order to accommodate all Members and their families comfortably and to avoid crowding. To further promote an equal distribution of attendance on these four nights, Members are urged—though not required—to attend according to the following schedule: Those whose last names begin with letters A through D are asked to attend on Monday, May 15; E through K on Tuesday, May 16; L through R, Wednesday, May 17; S through Z, Thursday, May 18. Although Members will, as always, be asked to present their membership card or invitation card for admission, the attendance arrangement, by alphabet, is an optional one.

As in the past, free round-trip charter bus service will be provided between the Loop and the Museum. These CTA busses, marked *FIELD MUSEUM,* will originate at the southwest corner of State and Jackson, with stops at the southwest corner of Michigan and Balbo. Two busses will be making continuous circuits, beginning at 5:45 and passing at about 15-minute intervals, until the Museum closes.

Plenty of free parking is available in Soldier Field lots and the Planetarium parking area, with a shuttle bus continuously circling the areas and collecting and discharging passengers at the Museum's south steps.

From 6 p.m. to 8 p.m. the Museum's food service area will provide complete dinners or snacks.

So plan your Members' Night visit now, reacquaint yourself with *your* Museum. Identical entertainment and educational programs will be offered on each of the four evenings, from 6 until 10 p.m.

### Botanists Promoted

John Engel, who joined the Field Museum staff in 1972, has been promoted to associate curator of botany. Engel's initial appointment was as Richards Visiting Assistant Curator of Bryology.

A native of Milwaukee, Engel did his undergraduate work and obtained his M.S. at the University of Wisconsin-Milwaukee. He was awarded his Ph.D. at Michigan State University. Engel's field work has included exploration and collecting in the Juan Fernandez Islands, southern Chile, the Falkland Islands, New Zealand, Australia, Tasmania, and Costa Rica. His special field of study is the liverworts.

William C. Burger, chairman of the Department of Botany, has been promoted to curator. He joined the Museum staff in 1965 and recently was made chairman of the department, succeeding Lorin I. Nevling. Nevling is now assistant director, science and education.

# VIRUNGA:

## *Or Whatever Happened to Albert National Park?*

**By Burt A. and Susan Ovrut**
**Photos by the outhors**

*Hippos wallow, flank to flank, in Virunga Park mudhole.*

OUR DAY BEGAN, as so many previous days had begun, with the patter of rain on the roof of the Land Rover. We lay still, listening to the sound reverberating through our tin-can environment. For two weeks we had been adrift on the seas of mud, whimsically called roads, in eastern Zaïre, and were not eager to resume the battle with the elements. We were enroute to Virunga National Park, Zaïre's best known game preserve.

Located in the remote interior of Africa, Virunga Park has attracted few of the tourists who annually visit the more accessible game parks of Kenya and Tanzania. The park lies along the eastern edge of the Congo rain forest, a vast tropical jungle stretching its green canopy over much of equatorial Africa. Though it is readily approachable from the air, an overland journey to Virunga National Park is a safari through difficulties. Our enthusiasm for the trip had long since vanished in the mud and gloom of the Congo forest. What we did not know on that rain-soaked morning was that we were only a few miles from the edge of the jungle and an end to our troubles. Several hours drive from the campsite, the rain forest gave way with amazing abruptness to rolling, treeless grasslands.

No traveller is left unmoved by the knife-edged

*Burt A. Ovrut is a graduate student at the University of Chicago. He and his wife, Susan, have made extensive trips into northern and western Africa.*

transition from jungle to grassland, from darkness to light, that takes place in eastern Zaïre. Henry Stanley, visiting the region in 1887, described his experience in emotional terms:

> From the Ituri we entered a narrow belt of tall timber . . . then, to our undisguised joy, emerged upon a rolling plain, green as an English lawn, into broadest, sweetest daylight, and warm and glorious sunshine. . . . We strode forward at a pace most unusual, and finally, unable to suppress our emotions, the whole caravan broke into a run.

Our emergence from the forest was only a prelude of things to come. In a few hours we stood on the rim of the Western Rift Valley, enjoying one of the most beautiful sights in Africa. On the valley floor several thousand feet below, stretching northward to the horizon, was Virunga National Park. Shafts of sunlight, breaking through the clouds, spotlighted herds of elephant, black buffalo and gazelle. Beyond the sun-lacquered surface of Lake Edward, the snowcapped Ruwenzori Mountains soared upwards to more than 16,000 feet. Far to the south, steam clouds spewed from Nyiragongo, an active volcano forming the park's southern boundary. The presence of volcanoes and thermal springs in the park gives a clue to the geological origin of the Western Rift Valley.

The African continent floats like a ship on the molten interior of the earth. Torn loose millions of years

*"We entered a narrow belt of tall timber . . . then, to our undisguised joy," wrote Henry Stanley in 1887, "emerged upon a rolling plain, green as an English lawn, into broadest, sweetest daylight . . . Unable to suppress our emotions, the whole caravan broke into a run."*

ago from its moorings to the Americas, Africa has steadily drifted eastward. The subterranean forces that pulled the continents apart have conspired, and may someday succeed, in the dismemberment of Africa itself. The continent has already been rent by two huge cracks. The westernmost of these is called the Western Rift Valley. It begins at Lake Malawi and cuts its way northward to the Sudan-Uganda frontier. Acting as a catch basin for heavy equatorial rains, the Rift Valley has become partially filled by four large lakes: in the south, Lakes Tanganyika and Kivu, and in the north, Lakes Edward and Albert.

Intense geological activity has formed a series of volcanoes, the Virunga Volcanoes, between Lake Kivu and Lake Edward. These act as both a hydrographical and political barrier, dividing the Western Rift Valley into two, distinctly different parts. In the southern valley is the Tanganyika country, a human and fluvial backwater. Here, nineteenth century ivory and slaving empires rose and fell; here at Ujiji on Lake Tanganyika, Stanley found the aging and disillusioned David Livingstone. In 1967 a rebellion, centered around the town of Bukavu on Lake Kivu, reasserted the traditional violence of the Tanganyika country. Lake Tanganyika is kept from becoming a stagnant inland sea by its slow drainage into the Zaïre River system via the Lukaga Channel. This channel is the only outlet from the entire southern Rift Valley and as such is sluggish and inefficient.

North of the Virunga Volcanoes, the Rift Valley has a completely different character. Water flowing into this part of the valley is destined, not for an African lake, but for the Sudan, Egypt, and, eventually, the Mediterranean Sea. In Virunga Park small streams coalesce to form the Rutshuru and Rwindi Rivers, the western sources of the Albert Nile. These rivers empty into Lake Edward which, in turn, drains northward into the Semliki River. Swollen by the runoff from the Ruwenzori Mountains, the Semliki is a river of major proportions by the time it flows out of the national park and into Lake Albert. When these waters finally leave Lake Albert they do so as the Albert Nile.

With its abundant water and open grazing land in the midst of dense jungle and rugged mountains, the Western Rift Valley attracted large numbers of wild animals. When the first Europeans arrived in the area in the late 1800s they found unparalleled concentrations of wildlife. Stanley took time out from his skirmishes with the natives to describe the teeming life on the shores of Lake Edward: "The river-like arms of the lake, now narrowing and broadening, swarmed with egrets, ducks, geese, ibis, heron, storks, pelicans, snipes, kingfishers, divers and other water birds."

The Western Rift Valley and the surrounding mountains were also the home of a rare animal—the mountain gorilla. Much of the ecological controversy that later surrounded the Rift Valley revolved around this

shy creature. The coming of white men to the eastern Congo meant the introduction of modern firearms and the beginning of the slaughter of wildlife. Accounts of early expeditions to the Western Rift Valley tell of the wholesale killing of some of Africa's most majestic animals, with the skin, the tail, or a single plume as the sought-after prize. The gorilla was an especially desirable trophy. In the early twentieth century, one book after the other photographically recorded the slaughter of gorillas. The carnage was so great that, by World War II, travellers in the eastern Congo reported not seeing any of these animals.

Such large-scale hunting might have led, as elsewhere in Africa, to the complete extermination of wildlife had it not been for a bizarre mitigating circumstance. This came in the form of the tsetse fly and the pernicious Gambian sleeping sickness that it carried. The disease is believed to have been introduced into the Western Rift Valley by porters in Stanley's 1887-1890 expedition. It spread rapidly along the Semliki River and the northern shores of Lake Edward. The impact on the health of the people and their cattle was so great that the valley floor was abandoned for the healthier Ugandan highlands. Attempts by Belgian authorities to repopulate the Rift Valley in the early twentieth century ended in tragedy. By 1920 most of those who had been resettled in the region were either dead or had been hospitalized.

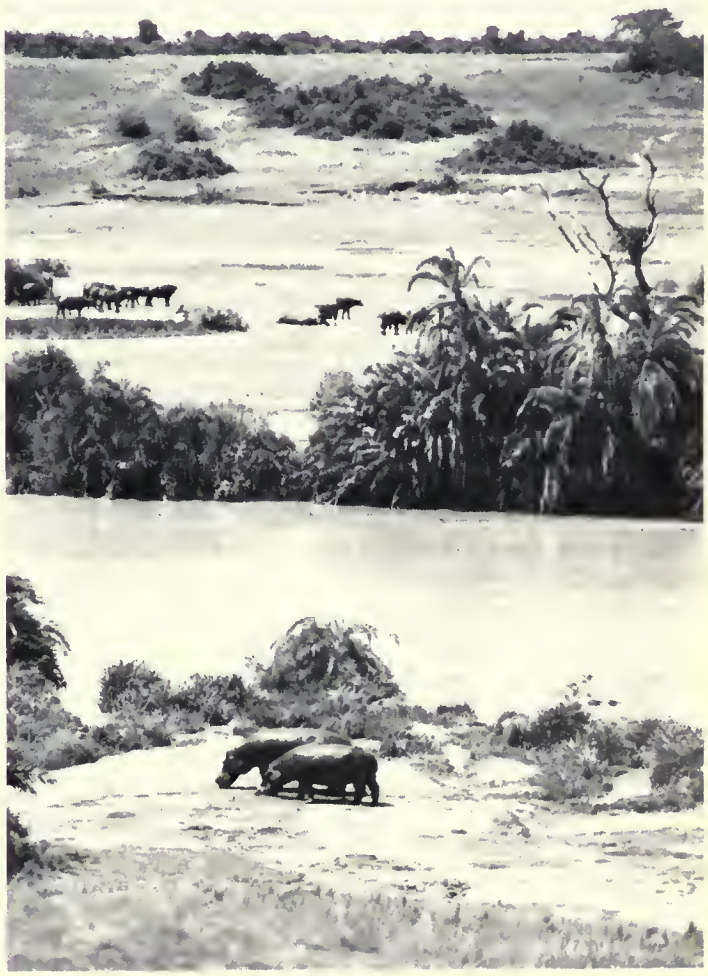
But this confrontation between man and disease, disastrous as it was for humans, was a blessing for the wildlife of the area. It kept the pressure of human habitation and cattle grazing to a minimum. The wild animals, immune to sleeping sickness, had time to breed and replenish the herds. The balance between hunter and tsetse fly kept the animal population stable. When the Belgian government finally decided to establish game preserves, the Western Rift Valley was an obvious first choice.

Mounting pressure from wildlife conservation groups began to have an effect by the middle 1920s. King Albert of Belgium visited America's Yellowstone National Park in 1919 and was favorably impressed. When conservationists, notably Carl Akeley* of the American Museum of Natural History, asked him to set up a gorilla preserve in the eastern Congo, Albert responded by establishing an extensive multianimal preserve in the Western Rift Valley. Albert National Park was created by royal decree in 1925. Successive decrees, up to 1935, added substantial areas to the original tract. The park today occupies nearly all of the Rift Valley floor from the northern shores of Lake Kivu to just north of the Ruwenzori Mountains, a little more than 8,000 square miles of varied terrain. Its confines include some of the Virunga Volcanoes in the south and most of the 800 square miles of Lake Edward.

Eight peaks comprise the Virunga Volcanoes, the tallest of which, Karisimbi, rises to 14,782 feet. Their height and stark, basaltic appearance account for the generic name *virunga* which derives from a native term *kirunga*, meaning "high, isolated mountains that reach the sky." Two of the volcanoes, Nyamuragira and Nyiragongo, remain active. Both are within the national park's boundary. A spectacular eruption of Nyamuragira in 1912 was witnessed by Sir Alfred Sharpe:

> All the country along the shore of Kabino was buried in black ash, the crops were destroyed, banana trees fallen, native huts partly buried or crushed flat . . . . The roar from the volcano was incessant—a steady, deafening roar—and the whole country below us was

*Hippos and buffalo at their leisure along the banks of Zaïre's Rutshuru River. African fish eagle nest occupies top of tree at right, across river.*



* *Carl Akeley also served as Field Museum's taxidermist from 1896 to 1909.*

lit up by a column of fire lava, and red hot material, which was shot up many thousands of feet. . . . The whole of the water at the north end of Kivu was hot by this time, and many thousand fish were floating dead. . . .

Some idea of the fierceness of this outbreak while it lasted may be gathered from the fact that at the post of Walikali, in the Congo forest 100 miles to the west, ashes fell heavily for two days, while the eruption was heard at Beni 140 miles to the north. . . .

In December, 1976, and continuing for several months into 1977, both volcanoes were again in upheaval. Lava poured into heavily populated areas with devastating consequences.

Albert National Park survived the political turmoil that followed the Congo's independence from Belgium. In 1971 President Mobutu announced his Authenticity Program which, among other measures, changed the name of the country from the Democratic Republic of the Congo to Zaïre, and africanized European-sounding place names. Albert National Park was given the African name previously applied only to its volcanic mountains. It was the Virunga National Park which lay stretched out before us on that summer day.

THE ROAD WOUND AND TWISTED down the steep escarpment, finally descending to the valley floor. A small sign indicated that we were entering Virunga National Park, but a sign was hardly necessary. It was obvious from the large herds of gazelle and black buffalo on both sides of the road that we were in a first-rate game preserve. In the distance, elephants foraged in a cluster of trees and crested cranes strutted and pecked among groups of impala. We drove on to the little settlement of Rwindi, the tourist headquarters in the park. Camping is not permitted in Virunga, and one must either leave the park boundary at night or stay at the hotel in Rwindi. Animals were everywhere, even at the door of the hotel. At night an elephant regularly came to scavenge from the kitchen and hippos bellowed from a nearby stream.

The next morning we hired the mandatory government guide and began our safari. Following the dictates of the guide, we drove off the main road and motored across savannah land toward the Rutshuru River. We arrived suddenly on top of a high cliff overlooking the river's west bank. The view was spectacular. The pastel colors of land, river, and sky seemed like a painting in which the pictured animals slowly moved. Grazing together on the meadow below were zebra, wildebeest, and topi. In the dense growth of papyrus lining the river, vividly colored tropical birds hopped from branch to branch like moving flowers. Every tree seemed to harbor at least one African fish eagle (*Haliaeetus vocifer*), a close relative of the North American bald eagle. These took to the air at our approach and, swooping down to the river, drew our attention to a remarkable phenomenon. Wallowing in the grey mud along the river bank were hundreds of hippopotami, already seeking in the mud relief from the hot morning sun. Virunga Park is famous for its estimated 30,000 hippos, a number far exceeding what would normally be expected in such an environment.

The Rift Valley was already overpopulated by hippopotami when the national park was founded. It was expected that their numbers would decline under the more normal ecological conditions created in the park, but this has not been the case. Today, in every river, lake, and almost every mudhole, one is sure to find hippos. By day they are either submerged under water, with just nostrils and ears protruding, or covered with mud, waiting for the sun to set. At night the hippos emerge from the water and, in tramping, crowded lines, range out over the savannah in search of food. Their incessant comings and goings cut deep tracks in the soft ground, evidence by day of the hippo's nocturnal adventures. We followed the Rutshuru River to where it empties into Lake Edward and visited the fishing village of Vitshumbi. Although found elsewhere in the park, crocodiles shun Lake Edward. This is at least partially responsible for the large number of fish found in the lake. During the lean years of World War II the Belgian government established a commercial fishery at Vitshumbi, much to the chagrin of the park authorities. Despite efforts by conservationists to prohibit it, commercial fishing still continues.

We arrived in town amid a flurry of noise and activity signalling the men's return from the morning fishing. After docking their dugout canoes or rough-hewn boats, the fishermen bring the catch to an open-air building. Here the fish are cleaned and weighed to the rhythmic chant of African work songs. There is no refrigeration at Vitshumbi, but the fish are fresh and the markets nearby. In the village beyond the fishery, the smoke of cooking fires rises up between conical straw huts with incongruously large marabout storks perched on the roofs. The storks lurk by the hundreds in the village, living off scraps from the fishery. On the beach, boats are repaired and nets mended, much of this work done by children. To our amazement, a battered and ancient elephant lumbered his way along the beach, accepting handouts of food. Nearing the end of his days, the elephant apparently felt more comfortable in the noisy, but benign, environment of Vitsumbi than in the wild savannah surrounding it.

In the full heat of midday, the animals retreated deep into the shade. Driving across a deserted savannah, we returned to the cool comfort of the hotel. Each succeeding day saw us exploring every corner of the park searching for, and finding, lions, topi, waterbuck, wart hogs, wildebeest, baboons, elephants, black buffalo, zebra, monkeys, and always the non-elusive hippopotamus.

*Processing the day's catch at the Vitshumbi fishery.*

The one animal we did not see was the mountain gorilla, the animal whose need for protection catalyzed the creation of Albert National Park. The existence of this great ape in the eastern Congo was surmised by Stanley in 1890 but no white man actually saw one there until twelve years later. In 1902 a German officer, Captain Oscar von Beringe, observed several interesting primates while climbing in the Virunga Volcanoes:

> We spotted from our camp a group of black, large apes which attempted to climb to the highest peak of the volcano. Of these apes we managed to shoot two . . . . [One of the two] was a large man-like ape, a male, about 1 1/2 m. high and weighing over 200 pounds. The chest without hair, the hands and feet of huge size. I could unfortunately not determine the genus of the ape . . . .

Von Beringe's ape turned out to be a new species of gorilla, subsequently called *Gorilla gorilla beringei* in his honor. The common name, mountain gorilla, distinguishes the animal from a lowland cousin in western Africa. A general slaughter of the fierce-looking, but gentle creature followed its discovery. Collectors for museums alone killed more than 50 by 1925 and many were taken by amateur hunters. The gorilla was forced higher into the mountains and, as far as the tourist was concerned, disappeared from view. Even in the mountain retreat, the gorilla was not left in peace.

Outside the park boundary human encroachment on its territory was strong and unyielding. Armed with increasingly sophisticated tools, Hutu farmers in neighboring Rwanda began extending cultivated fields further up the mountainsides, destroying the forest and vegetation necessary for the gorilla's survival. The ape's environment was further damaged by cattle, brought to graze in the high mountains by Watutsi herdsmen. Incursions by cattle into the national park itself were frequent and Belgian authorities were not vigorous in maintaining the integrity of the park's boundaries. As a consequence, the ape population both outside and inside the park continued to decrease. A careful study of the mountain gorilla in 1960 concluded there were approximately 8,000 to 9,000 of them in the eastern Congo. Although this figure was larger than expected, it was considerably smaller than the number of mountain gorillas at the turn of the century. Since 1960, increasing human demands on the forest environment has resulted in a further decline of the great ape.

From their inception, the game parks of Africa have faced major threats to their continuance. A burgeoning human population, needing land for cultivation and pasturage for its cattle, presses relentlessly against the boundaries of wildlife preserves. The destruction of the mountain gorilla's habitat by the Hutu and Tutsi peoples of Rwanda is just one example of this pressure. In Kenya and Tanzania the pastoral Masai habitually graze their cattle on the rich grasslands of the national parks. The cattle tend to trample and overgraze their pasturage, quickly reducing it to wasteland. This situation is exacerbated in times of drought when the presence of artificially maintained waterholes in the game parks induces more frequent visits by Masai herdsmen. With their own waterholes dry and their cattle dying, it is difficult for the Masai to respect park boundaries which are, very often, marked only on a map.

An even greater threat to wildlife preserves is posed by illegal hunting. Most parks do not completely encompass the migratory routes of their fauna. As a result; many wild animals spend part of each year outside protective confines. There, they fall prey to poachers who, near Serengeti alone, kill more than 40,000 animals annually. Every season, when the herds return to the national parks, it is in smaller numbers.

With the exception of the mountain gorilla, and in spite of large-scale poaching during the turbulent post-independence period, Virunga National Park has been successful in protecting the many animals within its boundaries. Well managed, the park continues to flourish. Masters of the prehuman world, coequals with agricultural man, the wild animals of the earth now find themselves corralled into small enclaves such as Virunga Park, saved temporarily by the tourist dollar from total extinction. Whether or not they can survive the onslaught of man and machines remains for future generations of Africans to decide.

Whatever happened to Albert National Park? So far, it is alive and well as Virunga National Park in eastern Zaïre.

# OUR ENVIRONMENT

### Ginseng Status Reviewed

Ginseng, an herb native to North America, has long been esteemed by practitioners of folk medicine for its wide range of alleged curative effects. The Mohawks, the Cherokees, George Washington, and Daniel Boone all engaged in the gathering and trading of this medicinal plant. Most of it was shipped to the Far East, usually Hong Kong, for sale to the Orientals, who value ginseng's medicinal and alleged aphrodisiac qualities. As with so many other things nowadays, though, ginseng is becoming scarce in some areas, with high prices, overcollecting, and ignorance of early conservation methods all contributing to its demise, according to the National Wildlife Federation.

The Endangered Species Scientific Authority (ESSA), following a state-by-state assessment, recently said it was unable to find enough data to justify continued exportation of wild American ginseng (*Panax quinquefolium*) for the 1977-78 season. The ESSA is responsible for the biological review of applications to export or import species that fall under the Convention on International Trade in Endangered Species of Wild Fauna and Flora. Admitting that it may be relatively abundant in some regions, the ESSA banned export of ginseng in all states except Michigan because no positive evidence could be found to indicate that it would not decline further.

What has happened to ginseng is now a familiar story with many plant and animal species. Always difficult to find except by the most seasoned hunters, access to remote areas where it grows has made it easier to obtain; its habitat is being modified by encroaching development; the hardwood forests where it grew have been cut down; and high demand has brought high prices which appeal to new collectors. These entrepreneurs often have little regard for conservation practices which would promote the plant's survival.

Commercial exploitation of ginseng, or 'sang as it is commonly known, began in the 18th century after Jesuits discovered it in Canada. Exports of wild ginseng continued into the 19th century, and the markets were so attractive that people began cultivating the plant in gardens. From a low average price of 42c a pound in 1822, the price per pound for the magic herb has risen to almost $100 in 1977. In 1975, a record 248,854 pounds were exported. Despite attempts to get rich quick in the ginseng business by cultivating it, sellers know that it is the larger and more potent wild ginseng which brings the premium prices. Furthermore, garden plants are subject to wilting, blight and rot.

Ginseng takes two years to germinate and does not flower and seed for four or five years. It seems to like dark, damp ground, plentiful in Appalachian and Ozark mountain "hollers." In the fall when the ginseng plant is golden and the berries bright red, 'sang diggers set out with a shoebox and hoe to the carefully guarded spots where the plants grow. A good digger may collect as much as two pounds of roots in a day, which are then hung to dry behind the stove from the cabin rafters, until the dealer comes by to pick up the harvest. According to the *Foxfire* book, five pounds of fresh root will yield one pound of cured or marketable root.

"The conservative 'sanger only dug roots in the fall of the year and carefully replanted the seeds, or the rhizome extension called a 'quill' or 'bud,'" wrote Marie Mellinger in *Foxfire*. Now, people are digging all year long, taking the plants before the three-pronged leaves appear, a sign of plant maturity. This premature harvesting and carelessness in replanting the seeds may be the cause for the increasing rarity of ginseng, according to many botanists and veteran 'sang diggers.

Not everyone agrees that the ban on export of wild ginseng is warranted. Kenneth Wilcox, a North Carolina drug company owner, who buys 15-20,000 pounds of ginseng a year, said he thinks ginseng possibly may be endangered in some areas, but is "definitely not endangered" where he buys, mostly in North Carolina, Tennessee, Virginia, West Virginia, and Kentucky. He and other drug company representatives have met with ESSA officials to persuade them to lift the ban. Wilcox favors allowing states to put a season on ginseng collection. Michigan, the only state exempt from the ban, is the only state that regulates ginseng collection.

The Federal Endangered Species Permit Office issues export permits for cultivated ginseng. How cultivated is distinguished from wild is mainly a matter of accepting the sellers' word, according to the Permit Office.

Ginseng is not listed on U.S. Endangered Species List, but is already included in many state lists of endangered, threatened, and rare plants. Also, it is named in the Smithsonian Institution's compilation of "Endangered and Threatened Plants of the United States." The U.S. Fish and Wildlife Service has announced that it is undertaking a review of the status of American ginseng, which has been observed in the wild in at least 32 states and three Canadian provinces, to determine whether the plant qualifies for protection under the Endangered Species Act of 1973.

### Eastern Indigo Snake in Trouble

Docile, slow-moving, even beautiful, the once common eastern indigo snake (*Drymarchon corias couperi*) is fighting to retain its position among the serpent populations of the southeastern U.S., reports the National Wildlife Federation. The eastern indigo is an extremely large and lustrous species, with a blue-back or purplish body (hence the name "indigo") and tinges of red, coral, or cream around its chin, throat, and cheeks. With a fairly stout build, the snake will attain a length of up to 8½ feet. Nonpoisonous, its feeding habits are often considered beneficial as it preys upon snakes, both venomous and nonvenomous, mice, rats, lizards, frogs, and birds. The eastern indigo is the

northernmost representative of an otherwise mostly tropical species, and once ranged from southern South Carolina to the tip of Florida, and in southern Georgia, Alabama, and Mississippi. Today the snake is found only in Florida and Georgia. Population levels have dropped so dramatically over the past two decades, that in 1971 Florida offered complete protection against the "taking, selling, or possession" of the snake as a threatened species.

What has happened to this harmless creature? Like so many native wild species, it is taking a back seat to man. Massive development and intensive agricultural practices have destroyed much of the snake's habitat. More important, the snake is a common victim of commercial exploitation and indiscriminate killing. Because of its high value on the pet market (mail order dealers often list the snake at well over $100), over-collection and black market operations have contributed significantly to the population's decline. In addition, the snake is often killed or disabled by participants in rattlesnake rodeos who gas gopher tortoise burrows during their annual winter round-ups. The eastern diamondback rattlesnake as well as the eastern indigo use the burrows as over-wintering dens. Thus, when the snake hunters dump from one to several ounces of gasoline down these holes in an attempt to "gas" out rattlesnakes, the eastern indigo is an unfortunate co-victim.

### Zebras Proposed for Endangered List

Two species of zebras, the victims of excessive killing both for their hides and because they compete with livestock for available food supplies, have been proposed for the endangered list by the U.S. Fish and Wildlife Service. The proposal would place the Grevy's zebra of Kenya, Somalia, and Ethiopia and the Hartmann's mountain zebra of southwest Africa and Angola on the endangered species list.

Grevy's zebra numbers appear to have plummeted in the last decade. The only sizable populations are in northern Kenya where it has been estimated that about 1,500 animals survive. This is down from more than 10,000 in 1971. In the last 2 or 3 years uncontrolled shooting has wiped out entire populations. On the Leroghi range, part of the Samburu Grazing Scheme, where 1,500 animals were counted in 1975, they are virtually non-existent today.

Although Kenya law protects zebras, poachers are still a major factor in the species' decline, with 8,000 Grevy's zebras estimated to have been poached in the last 3 years. The price of zebra skins, used to adorn walls and floors of homes, has recently skyrocketed from $150 to as much as $2,000.

The Hartmann's mountain zebra is also killed for its hide, but to a much lesser degree. The main concentration of the species is now restricted to Namibia where numbers total less than 2,000 individuals. In the 1950s, between 50,000 and 75,000 occurred in this general area. In 1960, the estimate was 15,000 and in 1970, 7,000 animals. The decline was brought about when man altered the environment by introducing livestock. The competition between zebras and cattle, sheep, and other livestock for available food resulted in ranchers destroying zebras in vast numbers. There are no effective means to control the slaughter. With the current political unrest in Namibia and the associated abundance of firearms in the area, there will undoubtedly be further indiscriminate destruction of zebras.

If this rulemaking is finally adopted, the two species, including their hides and products made from them, could not be imported into the United States without a permit, which would only be issued for scientific purposes or to enhance the survival or propagation of the species.

### Home Air Often Polluted

University of California scientists, aided by the U.S. Energy Research and Development Administration, have just completed initial studies on six single-family homes in the San Francisco Bay area and have concluded that the air *inside* the average home is often more polluted than air on a smoggy day outdoors.

The study, which utilized sophisticated instruments to monitor inside air quality 24 hours a day, has raised some serious concerns over the effectiveness of new building codes in President Carter's legislative energy package. Although the Environmental Protection Agency has never set air quality standards for indoor pollution, the study showed that indoor levels of such pollutants as carbon monoxide, nitrogen oxide, vinyl chloride, and flourocarbons are often two to three times higher than existing outdoor air quality standards set by state and federal agencies.

According to the study, the household pollutants result from aerosol sprays, cigarette smoke, organic compounds used in cleaning and cooking, and, most frequently, from poorly constructed or improperly serviced gas appliances.

The researchers indicated that better ventilation is possible through the use of exhaust fans over stoves and tighter venting leading outside from gas furnaces. The study indicated that most new, well-constructed, single-family houses have air exchange rates of one air change per hour (ACPH). Energy conservation measures now being considered would limit this to one-quarter to one-half ACPH, thereby allowing high concentrations of pollutants to develop.

The Energy Research and Development Administration has been involved in drafting a national model building code for use by builders to make homes and buildings more energy efficient which may be used as a blueprint for the national building code called for in President Carter's legislative energy package. However, the code does not include considerations for indoor pollutants.

# Male and Female: Anthropology Game

By Michael Story

Members' Night, to be held this year on May 15, 16, 17, and 18, has always been a challenge and inspiration to the Museum staff. The annual event sees thousands of curious members discovering and rediscovering natural history wonders as well as the Museum's behind-the-scenes workings. As part of the staff's job of educating and entertaining its guests during these special nights, each department is expected to produce a demonstration, an explanation for an exhibit of interest to this diverse audience. One of the most successful of these is a simple, thought-provoking exercise called the "Anthropology Game," devised several years ago by Bennet Bronson, associate curator of Asiatic archaeology and ethnology.

The first anthropology game was titled, *Where Does It Come From? The Basic Anthropology Game.* The goal was to involve the members in the thought process of an anthropologist as he attempts to determine an artifact's origin. The game format consisted of a large work table covered with brown paper on which 38 artifacts were arranged. Four possible proveniences were listed below each object. Players were given a handout containing the statement of purpose, rules, and space for answers. The correct choices and the reasons for them were listed on attached pages. In keeping with the just-for-fun spirit of a game, cheating was possible and left to the discretion of the individual player.

So popular was the game format that it is now a Members' Night fixture, eagerly awaited by both the members and the staff, who congregate before the doors open to test their knowledge and game-playing skills. More recent Members' Night variations on the theme have included: *What Is It?*—determining the usage of various artifacts and fragments of artifacts; and *Spot the Fake*—selecting a genuine ancient artifact from among some very accomplished imitations. In August 1976 the game in its newest guise—*Male and Female: Anthropology Game*—became a year-round public exhibit.

The script for *Male and Female: Anthropology Game* states that each of us has stereotyped conceptions of the sexes' respective economic and social roles and the kinds of tasks that men and women should perform.

The player is asked to look at each of 38 artifacts from the Museum's collections as an anthropologist would and decide whether it is—or once was—used by men, by women or by both. For instance: Number 22 is an exquisite example of a 19th century macramé beaded purse from New Guinea. Were purses like this carried by men, women or both? The printed answer states "men" and goes on to say that this area of New Guinea contained societies where our ideas of men's and women's roles were nearly reversed. Men were expected to be flighty, vain, and obsessed with personal appearance. Women, on the other hand, were to be practical, to dress plainly, and perhaps even to take the initiative in courtship.

*Male and Female: Anthropology Game* contains artifacts from cultures throughout the world including: a Fijian cannibal fork; Egyptian hieroglyphs; a German beer vessel; a Tibetan rosary; and a contemporary American perfume, which the answer states is also called "skin bracer" or "after shave lotion." The script warns the player that answers are not always as obvious as they seem and, indeed, there are quite a few surprises along the way. Upon completion, correct answers are tallied and the player can compare his or her score with a

*Cannibal fork, Fiji Islands. Was this utensil used by men, by women, or by both?*

*Michael Story is assistant in Public Relations.*

*Is this brass headdress, worn by performers acting as royalty in the* wayang wong *(classical Javanese dance-drama), worn by a king or prince, a queen or princess, or any person of royal blood? This is one of 38 artifacts in Field Museum's unique quiz game, Male and Female: Anthropology Game.*

rating scale: 20—good, 25—very good, 30—superlative, over 35—better than many anthropologists would do, and under 20—"you are either a poor guesser or hardcore chauvinist." In the end, the player will have learned some fascinating information about sex-role definitions in many different societies and possibly taken the time to reconsider his or her own male and female stereotypes.

In its new role as a special public exhibit, the anthropology game needed more than brown paper and a table to make it work—but not much more, which is one of the distinct advantages of this approach. The main substance of the game, the artifacts, or any other materials can be flexible, but the more intimate, and consequently less expensive, scale seems most effective. In order to give the anthropology game a unique visual character and at the same time stay within the game's moderate budget, the Museum's Department of Exhibition converted two existing wall-mounted exhibition cases to horizontal floor cases. The result was two low, side-by-side cases that provide an interesting contrast to hall after hall of tall, glass-walled exhibit cases. The low horizontal design also lends itself to more intimate involvement in the game as the players, particularly the younger ones, can lean their elbows on the wooden frame of the case and comfortably contemplate the glass-covered artifacts. At the top center of each case rests a vertical island that states the name, introduction, and purpose of the anthropology game. Around the perimeter of each case are numbered question-and-answer placards which correspond to the numbered artifacts. Pockets on the side of each case contain answer sheets so a player can record his or her success at playing anthropologist at the Museum.

Located in a busy area near the cafeteria and school lunchrooms, the game is in almost constant use. The mentally and physically involving aspects of the game, and the word "game," make the exhibit particularly popular with younger museum visitors though the game is designed for and played by all ages. The present anthropology game is no pushover. To the staff's knowledge, there has been no witnessed perfect score. Interestingly enough, the highest known score, 36 out of a possible 38, was tallied by the daughter of a staff member, while the best a professional anthropologist has scored is 33.

The anthropology game is indeed what its name states, but the themes and variables it plays with are intrinsically more valuable than passing "Go" or accumulating plastic hotels. The game is now a valuable part of the Museum's regular public offering—supplementing, not supplanting, the permanent exhibits.

Soon, Members' Night will again be here, and already a new game is in the works. The preliminary title is *Friend or Foe?,* a game which will attempt to demonstrate the misconceptions and ambiguities that exist concerning things harmful and things not. For example: Two specimens—a coral snake and its mimic, the false coral snake— will be mounted side-by-side. Which is lethal and which would make a novel pet? If you knew the specific color pattern of the venomous reptile, you could safely make your choice. The unique feature of this newest game is that it is not just about anthropology, but will include specimens from the Museum's three other major scientific divisions—zoology, botany and geology —demonstrating the nearly limitless adaptability of the game format. □

*This article has been adapted from one which appeared in the January/February, 1978, issue of* Museum News. *Copyright © 1978, American Association of Museums.*

*Stuffed silk and cotton embroidery from Shensi Province; 19th century. Width 8¼ inches (20 cm); height 2 inches (5.1 cm). Field Museum collection. The eyes represent those of Yen Kuang P'u Sah, Buddhist goddess of the light of eyes. On the second day of the second lunar month, the rite "Burning of 32 Candles" would be held in her honor. Persons with visual disorders or who wished to preserve their good eyesight would make offerings to this goddess. This pair of embroidered eyes was probably an offering to the goddess by a worshipper with afflicted eyes.*

# *Folk Art in China*

## Exhibit Opens April 6

In traditional China, before Mao, ninety-five percent of the population was illiterate, poor, and isolated from the refined cultural traditions of the ruling classes. This ninety-five percent, mostly farmers and landless laborers, constituted the "folk." The exhibition, on view in Hall 27 beginning April 6, is devoted to their art.

About half the objects in the exhibition come from Field Museum's collections. However, they are quite different from the objects in our regular displays, as one can see by glancing around the cases outside the entrance to Hall 27. The objects there, in Halls 24 and 32, were upper-class possessions. They are made of precious materials, tasteful in design, controlled in style, exquisitely finished, and often of great beauty. They also were (and are) very expensive.

By contrast, the objects exhibited in Hall 27 were originally cheap, having been made by and usually for people who were neither educated nor rich. The designs are simple. The materials are inexpensive—wood, bamboo, leather, cotton, paper, straw, clay, and stone. Yet, and this is the interesting point, these "folk art" objects are not rustic, not crude, and not at all unbeautiful. Their makers may have known little of the great traditions of Chinese civilization. Most would not have dreamed of signing their names to their work. But some were artists as great as any China has produced.

This is one of the main purposes of this show; to demonstrate that genius and creativity, in China as elsewhere, was not the exclusive property of the upper-class mandarins, the educated elite. Another purpose is to show a selection of art made by people who did not call themselves artists. Another is simply to exhibit a group of profoundly satisfying objects, flawless in form and brilliantly functional in design.

And still another is to illustrate what artists and craftsmen can do by hand, with the simplest of tools in a world without machine power and without factories. We feel that contemporary American craftsmen and artists can learn much from these objects in terms of design and technique.

In America we, too, once had folk artists, some as great as these. All have long since disappeared, just as has the entire culture of the folk, doomed by the spread of communications, education, and industrialization. In China this unstoppable process has not yet run to completion. One still can buy Chinese objects in stores (including some in Chicago) that are authentic folk art. The tradition is dying but still alive. The objects shown here are important on that count alone.

This exhibit was assembled and cataloged by Tseng Yu-ho Ecke of the University of Hawaii. It has already been shown at the Honolulu Academy of Art, the Asian Art Museum of San Francisco, the Los Angeles County Museum of Art, and—in a somewhat smaller version—China House in New York. After the exhibit closes on July 5 the objects will be returned to the lenders.

*Cotton appliquéd child's bib from Szechuan Province; early 20th century. Length 20½ inches (52 cm), width 16½ inches (42 cm). Field Museum collection. Around the collar is a lion, the protective force. On the pocket is a moth or butterfly with a happy human face.*

*Round wooden container with loop handle, province of origin unknown; 17th century; height (with handle) 18½ inches (47 cm), diam. 9½ inches (24.1 cm). Collection of Mr. and Mrs. Lowell S. Dillingham, Honolulu. The container is stained with red lacquer. Twisted wire serve as braces around the waist and at the foot.*

*Goddess carved from wood, Fukien Province; 17th century; height 8¾ inches (22.2 cm). Collection of Mr. and Mrs. David Eyre. Figure is dressed in court attire of Ming period.*

*Aerial view of Collins site. The clay-capped mound (B) is on the floodplain. A bluff-topped mound (C) is in the wooded area.*

# Prehistoric Missionaries in East Central Illinois

**By Thomas J. Riley and Gary A. Apfelstadt**

*Photos courtesy of the authors*

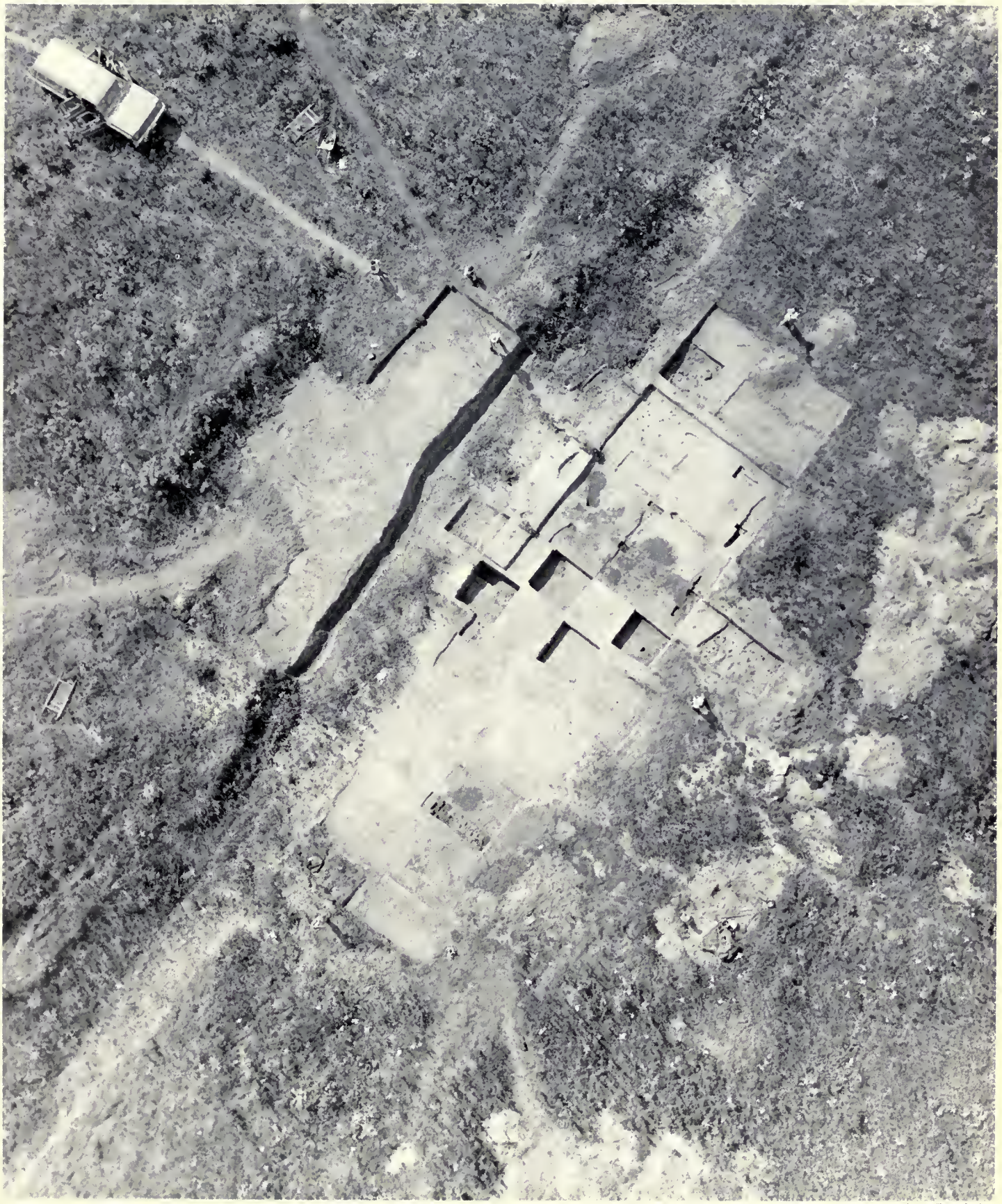
Between 700 and 800 A.D. a new social, political, and religious order was being established in the Central Mississippi valley. At Cahokia, near East St. Louis, Ill., work was then beginning on a number of large public monuments which, in the twelfth century, would make it the site of the largest community in America north of Mexico.

During the 400 years from the eighth to the twelfth century, countless large platform mounds were constructed at Cahokia. Most of them formed the foundations for temple structures and chiefs' houses, but ceremonial palisades, mounds for burials, and large wooden sun circles to chart the solar year were also built there. This area, now called the American Bottoms, drew its population from all over the Central Mississippi valley in the years around 1200 A.D. At its zenith, the huge temple town at Cahokia had more than 100 mounds and enough thatched houses for a population of 30,000—with a density probably exceeding that of most European cities of that age.

Above all the hubbub and bustle of Cahokia stood the massive platform mound known now as Monks Mound; even today its huge bulk, comprising some 22 million cubic feet, dominates the landscape outside East St. Louis. How Cahokia and similar sites—labelled "Mississippian" by archaeologists—came into existence

---

*Thomas J. Riley is assistant professor of anthropology and Gary A. Apfelstadt is a research assistant at the University of Illinois at Urbana-Champaign, Illinois.*



Christopher Allen, Whittlesey Foundation

*Aerial view of clay-capped mound at Collins site. Photo made from balloon. (Line to balloon from ground is visible at upper left as diagonal streak.)*

*A multiple-bundle burial excavated at the Collins site*

is one of the big mysteries of North American prehistory, and we may never know exactly what language group or base culture was responsible for Cahokia. Despite the striking resemblances of the temple platforms at Cahokia and other ceremonial centers of the Mississippi valley to Mexican temples of the same period archaeologists agree that there was no direct migration of large numbers of Mesoamerican Indians northward into the Mississippi valley.

One theory is that migrations from the lower Mississippi valley—chiefly the Caddoan area of Arkansas and Texas—provided the impetus for the development of Mississippian culture. Another theory is that Mississippian society is indigenous to the southeastern United States, coming out of a fusion of ideas and trade routes among the numerous local cultural groups located there.

While there is much that we do not know about Mississippian culture, we do know that its success rested on the spread of Mississippian ideals to people who were not originally in the mainstream of Mississippian political and religious institutions. Our own research in east central Illinois suggests that the far-reaching spread of Mississippian culture was based on what can only be described as "missionary activity" rather than on conquest or trade. The evidence comes from a number of archaeological sites smaller than Cahokia that seem to show definite Mississippian religious affiliations in a non-Mississippian social and economic matrix. The juxtaposition of Mississippian religious traits with non-Mississippian ceramics, burial types, and settlement configurations are analagous to ethnographically known cases of missionary activity.

Archaeologists often use cases of social change in modern societies to provide insights for interpreting the data of the past. Social change that has recently occurred on the South Pacific island of Tikopia, as observed over several decades by anthropologist Raymond Firth, may aid in our understanding of what was taking place in southern Illinois a thousand years ago: Beginning in 1928, Firth documented the conversion of the island population from paganism to Christianity. The Tikopians were never pressured into conversion by their English colonial administrators; indeed, British intervention in Tikopia affairs has been minimal until recent years, and the Melanesian mission of the Church of England abroad was responsible for the total conversion of this island by 1966, the time of Firth's last visit.

The mission was singularly unsuccessful for a long time. From 1858 until 1924 very few conversions were made, and the mission on Tikopia was staffed by Banks Islander and Tikopian lay ministers. In 1924, a local chief, the *Ariki Tafua,* felt that he could tap directly into the goods and services of a benevolent British administration in ways that his fellow Tikopian chiefs could not. No doubt he was religiously motivated as well, but for a number of years his brand of Christianity included the worship of his old gods as well as the new one, and he often gave them offerings of food.

The Tikopia chief may seem to us to have been hedging his bets by worshipping the Christian god and

pagan gods at the same time, but in fact he was trying to bridge a very tricky political situation. He was responsible for the harmony of a large part of the island of Tikopia as well as for its spiritual well-being. As a civil chief he had to keep the pagans of his district as well as the majority of his Christian followers happy. The chief was in the same position as the king of England who, whether he chooses to be an atheist or not, is still the head of the Church of England, a position that he is bound by law and tradition to fulfill.

In 1937 the Tikopia chief renounced his new religion for a short time, but in general, the growth of Christianity continued on the island until the final conversion of the pagan chiefs in 1956. Today, the whole island is Christian, and in the course of two generations, the last traces of traditional pagan practices have died out.

The Tikopia case of conversion is important because it gives us a picture of the conditions necessary for missionary activity to be successfully translated into religious conversion. Some of these conditions are (1) the presence of an outside "power" with economic and social resources perceived as greater than one's own; (2) the perception of benefit from tying into the religious system of that power; (3) no personal or societal disjunction between prior religious beliefs and the system that replaces it.

These three conditions can be met in a number of ways by different societies. If the society has an individual with an ascribed position in the religious hierarchy who adopts the new religion as Tikopia did, then the process of conversion can be relatively sudden and occur in less than a century. In other societies the process may depend on the collective perception of benefit by the society as a whole. This latter case usually involves societies with small numbers of people.

"Benefit" is an elusive term which can have different meanings, according to the situation. In some societies protection in war might be an overriding benefit, while in others, the creation of a more favorable economy may be more important. The most important of these conditions for guaranteeing the success of missionary activity, if we can judge from Firth's experience, is the third listed above; there can be no disjunction between the old and the new religious regimes. If there is a serious disjunction, that is, if the new religion cannot be adopted into existing social and economic institutions of the society, then the religion will most likely fail to establish itself.

The question of how the Tikopia example fits our hypothesis of missionary activity and the spread of Mississippian influence is an important one. There is no doubt that Mississippian culture in the Central Mississippi valley fits the first condition listed above—that there be present an outside "power" with economic and social resources perceived as greater than one's own.

In its heyday in the eleventh to thirteenth centuries, Cahokia's presence was felt in the far-flung corners of the prairie and as far west as the eastern Central Plains along the Missouri river. At the height of Mississippian influence in the midwest, around 1200 A.D., Cahokia's presence could be seen as far north as Aztalan, a Mississippian-like ceremonial center in southeastern Wisconsin, and as far west as the Steed Kisker site, a focus of Mississippian ideas and motifs near Kansas City, Missouri. Even the rise of Cahokia itself does not appear to be due to the invasion of people from some other area. Rather, it began with the adoption of ideas about religion and political and social organization by the local communities of southern Illinois that archaeologists call Jersey Bluff.

These Jersey Bluff people were one of a large number of midwestern cultures that scholars have termed "Late Woodland," chiefly because their lifeways were adapted to eastern forest-prairie environments. Late Woodland villages were generally modest, semi-permanent horticultural settlements. Maize and squash were grown in small amounts by Late Woodland villagers, but most of the vegetable protein in their diet appears to have come from acorns, hickory nuts, and other wild resources gathered at different times of year. Hunting was important too, and deer was the main source of animal food. The remains of a large variety of other mammals, wild fowl, and fish are to be found in the garbage heaps at long abandoned Late Woodland villages.

In many parts of the midwest this dependence on wild resources forced Late Woodlanders to abandon villages during specific times of the year to harvest nuts and berries that were only seasonally available in different habitats. Wild foods were also important in limiting the size of settlements. Serious food shortages and even famine conditions could occur if the population of a Late Woodland settlement exceeded the availability of nuts, berries, and other gathered foods at the leanest time of year.

In the southern part of Illinois, Mississippian settlements came to eclipse Late Woodland sites in size and number during the last century of the first millenium A.D. This was partly because Mississippian economy was based on intensive maize agriculture rather than a mixed horticultural and hunting-gathering economic regime. Late Woodland people began to intensify agriculture along the fertile, annually flooded bottomlands of the Mississippi river. As they intensified their agriculture they adopted and modified Mississippian social and religious practices and began to develop the massive trade system that characterized the later Mississippian sites along the major rivers of what is now eastern United States.

Some anthropologists argue that this change in subsistence and the expansion of trade were the primary causes of the adoption of Mississippian political and religious ideas by Late Woodland people. They suggest

that an increasing dependence on corn agriculture led to more permanent villages and larger populations within villages. These larger populations were due to the need for labor to intensify agricultural production and to produce a surplus of food to support social and religious activities. Larger populations demanded tighter social controls, and the construction of religious public works permitted the control and allocation of surplus resources to people who needed them.

The arguments of these anthropologists, who are sometimes called cultural materialists, emphasize the primacy of economic motives for the adoption of new religious beliefs and ideals. They suggest that Late Woodland people embraced Mississippian political and religious systems to cope with the problems brought on by an economic revolution from mixed farming-hunting-gathering to intensive maize agriculture.

Excavations at Cahokia and the other major Mississippian sites of the southeastern United States have not shed much light on the nature of Mississippian expansion. This is chiefly because of the sheer massive size of these archaeological sites and the complexity of the materials that they contain. A number of smaller sites located to the north of the Mississippian heartland may offer a better alternative to the large temple towns for solving the mysteries of Mississippian development and expansion.

A number of sites on the Spoon river in western Illinois have been investigated by Alan Harn of the Dixon Mounds Museum in an attempt to explain Mississippian expansion there. With the same end in view, the remarkable Mississippian ceremonial center at Aztalan in southeastern Wisconsin has been studied by Gordon Peters, a University of Wisconsin researcher. Near Danville, in east-central Illinois, the authors of this paper have recently completed a series of excavations at the Collins site, on the Middlefork—a branch of the Vermilion River. This site also shows evidence of Mississippian artifacts and ideas relatable to Cahokia, even though Collins is 180 miles to the north.

Collins, the site that these authors are most familiar with, is located on the floodplain and adjacent bluffs on the east side of the Middlefork River, some eight miles northwest of Danville. It dates from the period between 900 and 1200 A.D., bracketing the developmental years of the temple town at Cahokia. The site has been the focus for excavations by the University of Illinois Department of Anthropology since 1971, when work was begun by John Douglas, then a graduate student. Two fairly large earthen features are present at Collins. One is a flat-top pyramidal mound on the bluff above the floodplain; the other is a clay-capped rectangular platform located on an artificially filled and flattened ridge on the foodplain. Together they align with the rising sun at the winter solstice, a distinctly Mississippian religious feature.

The clay-capped platform on the river bottom was apparently the center of ceremonial activity, as it exhibits prepared fire basins which were used and filled repeatedly. At a late stage in its use, the platform was ripped through with trenches designed for the erection of large posts, several of which are noticeable in our excavation profiles. This large, rectangular platform structure appears to have been of great importance to Collins' Late Woodland inhabitants. Trash from numerous feasts that took place on the mound was swept to the sides of the prepared platform surface. Mixed with the bones and charcoal of the trash piles were distinctly Mississippian ceramics, small triangular projectile points, and other implements indicative of Mississippian involvement with the site.

The other marker of the winter solstice line is the large earthen mound on the bluff. Excavations by John Douglas have revealed that this mound was constructed in two distinct stages. The four-foot-high main mound is 40 by 35 feet in area, with its long axis oriented north-south. Most of the mound showed no signs of postmolds or other features that might have represented a structure; upon excavation, no internal features such as burials were recovered. The only discernible function of this main mound was as a winter solstice marker related to the platform mound on the river floodplain.

Abutting the large mound to the east is a subsidiary extension, which was found to be a small mound made by covering a burned scaffolding of juniper logs. The scaffold had supported five small bundles of human bones. These bundles had fallen as the platform burned in the last stages of a funeral ceremony. This ceremony resembles those practiced by several historically known Eastern Woodland Indian cultures.

Our own excavations recovered two other kinds of burials at the Collins site. A small mound, 2 feet high and 30 feet in diameter, was located about 250 feet north of the mound excavated by Douglas on the bluffs above the river bottom. A single interment was recovered from a shallow pit in the center of this mound. The body was laid on its right side, slightly flexed into a fetal position. The skull was apparently not buried with the rest of the body. A third burial type was noted from the floodplain itself, a little to the northeast of the prepared clay platform. There, in the center of a pit, was a neatly stacked bundle of human bones; the remains of four skulls were at the bottom of the bundle, and the larger leg bones were near the top. The bones of at least five and possibly as many as eight individuals were in this bundle.

The burials recovered from the Collins site provide us with a distinct contrast when compared with the mound alignments to the winter solstice and the presence of Mississippian ceramics and other tools. A small proportion of the ceramics from the site are identical to Cahokia specimens dating from between 900 and 1050 A.D. This is consistent with radiocarbon dates from the

*Mississippian burial mound at Aztalan, in southeastern Wisconsin.*

site and suggests Mississippian religious influence at the Collins site during this period. But the Mississippian religious influence was limited to the construction of ceremonial platform mounds aligned to the solar year. In contrast, the evidence provided by the burials recovered from the site suggests an indigenous Late Woodland set of burial patterns with no overtones of Mississippian influence. If we accept that funerary patterns are religious as much as perennial ceremonies based on the solar year, then there is evidence of Late Woodland religious beliefs as well as Mississippian religious ritual at the Collins site.

The explanation for this set of apparently contradictory religious phenomena at the Collins site brings us back to the Tikopia example of religious conversion. In the archaeological remains at the Collins site, there is no sign of Late Woodland peoples being coerced into adopting Mississippian religious beliefs. As a matter of fact, the archaeological evidence of Mississippian presence as opposed to influence is only slight, consisting of less than 10 percent of the ceramics recovered, a few gaming stones, and one small wall-trenched structure.

The construction of the platform mounds in solar alignment that we find at the site appears to be the result of the acceptance of certain Mississippian ideas by Late Woodland peoples living in the immediate area. Other Mississipian religious ideas, specifically those related to funerary ritual, do not appear to have been adopted by the inhabitants of the Collins site. This suggests that Mississippian religious ideas had never completely caught on at Collins, and brings to mind the dilemma of the Tikopia chief who, though a Christian, engaged in traditional pagan rites in the funeral ceremony of his non-Christian brother.

If we compare the evidence of the influence of Mississippian beliefs and ritual at the major ceremonial site at Aztalan in southeastern Wisconsin, we can only conclude that the "Mississippianization" of Collins site inhabitants was never fully accomplished. At Aztalan, fully 200 miles north of the Collins complex, the product of Mississippian influence was the construction of several complex pyramidal temple mounds as well as a fairly substantial palisade enclosing the locus of Mississippian ceremonial activity. To the northwest of these ceremonial mounds are located a number of large conical burial mounds, above and away from the ceremonial precincts. Despite the heavy influence of Mississippian ritual activities, the ceramics at Aztalan are heavily weighted towards local Late Woodland wares, with Mississippian sherds representing only 23 percent of the total ceramic inventory.

Interestingly, the Mississippian ceramics from Aztalan, like those from Collins, represent wares that were in use at the temple town of Cahokia around 1050 A.D., suggesting that these two sites are two examples of the same process of religious conversion. It would appear from the evidence now available that this process of conversion from Late Woodland "paganism" to "Mississippianity" succeeded at Aztalan while it failed at the Collins complex. The reasons for successful adoption of Mississippian ideas at one site, and their failure at the other remains a mystery, but it may be that the third requirement listed by Firth for successful conversion had something to do with it. Collins site inhabitants may have begun to recognize aspects of Mississippian religion that were not compatible with features of their economic, social, or ideological systems before the introduction of Mississippian ritual.

It is quite possible that Mississippian solar ritual was associated with a planting calendar that made more sense for intensive maize agriculturalists than it did for the Late Woodlanders of Central Illinois who depended on a mixed horticultural and hunting-gathering economy. The adoption of Mississippian ritual by the Collins inhabitants may have been disruptive to their seasonal schedule of economic activities, and such a cost may have outweighed any advantages they could see in permanently involving themselves with the Mississippian religious calendar.

The Collins site, then, might really be a case of missionary activity in east central Illinois—an example of a failed attempt at native religious conversion that took place some six centuries before the penetrations of European Christian missionaries into the Illinois country. □

# *Thumbelina: House Guest in Miniature*

By Ivan Barker

Very faint were the peeps I heard while walking along the parkway. The sounds came from the curbside. I looked for the source, but finding nothing, went on. The chirps were still audible when I returned, and this time I was able to locate their source. In plain sight near the curb was what seemed to be a large blackish bug, but actually was an unbelievably tiny featherless bird. Its short legs were propelling it toward the traffic lanes.

I picked it up carefully and looked around for the nest from which it obviously had fallen. All the nearby shrubs had been pruned, and only a few small cuttings were scattered about. Evidently the branch with the nest and its other occupants had been carted away. So I took my find home. It was obviously a recently hatched hummingbird. After a week's growth of feathers we identified it as a female *Calypte anna*, a local year-round resident species known simply as Anna's hummingbird.

For almost three weeks, "Thumbelina" — as we named the foundling— was a most interesting house guest. The feeding problem was easily solved. At the beginning, a few drops of a three-to-one solution of water and sugar from a medicine dropper every ten minutes or so was sufficient. At first, she inserted her tiny bill inside the tube of the standard-sized medicine dropper. Later she opened her beak wide, and let us practically ram the dropper down her throat. She learned to squeak when hungry, thus establishing for us the spacing of the feeding intervals. In time she learned to feed directly from a small vial held before her. Once she had to be left alone for almost four hours. Scarcely had we unlocked the door and begun to open it when we heard a whir of wings, and fluttering almost in our faces was a very hungry Thumbelina, squeaking most excitedly.

For the first few nights we placed her in an improvised nest and covered her. It was then we learned that hummingbird fledglings do not foul their own nest, but are "housebroken" by instinct. Thumbelina's feathers grew rapidly, and soon she was exercising her tiny wings. It was fascinating to watch her learn to fly. At first she merely elevated herself in the air an inch or two above her nest, then dropped down. A day or two later she managed a vertical lift of four or five inches. The next day she rose about a foot and then moved horizontally to the rim of a lampshade. She never returned to her nest.

A small branch of blossoming escalonia fastened with a clothes-pin to the floor lamp became her favorite perch. Even after it withered, she preferred it to fresh branches.

Once she had mastered the intricacies of hummingbird flight, she thoroughly investigated the house, making neat right-angled turns through open doorways as she sped from room to room. She liked to be where there was activity. A narrow rail on the kitchen spice cabinet became a favorite observation post. When cooking was underway, we were fearful she might alight on the rim of a hot pan. At first we simply shooed her away, only to have her streak into the dining room and then return to the kitchen.

Then we found a more effective way to keep her out of the kitchen: We clipped her favorite perch from the floor lamp in the living room, took it to the kitchen, and held it close to her. She happily hopped aboard and accepted the ride to the living room, where she would stay for 10 or 15 minutes, provided one of us was also there. The only other solution was to shut the door to the kitchen.

Even without a parent bird to teach her, Thumbelina thought she knew the source of nectar. When she learned to fly she went exploring, poking her needle-like bill into the very center of each one of the flowers in the drapes and each upholstered rose; but after a few days of this she learned to scorn floral facsimiles.

We were cautious of doors to the outside and chased her away when a doorbell rang. Most of our friends were aware of our unique house guest and became accustomed to the swoopings and dartings and buzzings of our superb aerialist. One day a visitor who hadn't been informed about Thumbelina knocked and, unthinking, we opened the door, Before we could utter one word of caution, Thumbelina had jetted forward and zeroed in on the artificial flower on the visitor's lapel. The startled lady jumped back a full foot. Apologies and explanations were quickly made, and after our visitor had recovered she enjoyed watching Thumbelina whir about the house, a sight few ever are privileged to see.

Eventually the time came when we thought that our house guest should be released. We knew that sugar water does not contain the vitamins or nourishments of nectar, and we did not know how to provide the proteins hummingbirds obtain from small insects in some flowers. Before giving her freedom, we decided to weigh her. She tipped our small postal scale at just barely over one-sixteenth of an ounce. Had we thought to obtain her weight when we adopted her we could have had a complete record of her daily growth.

Before releasing Thumbelina we placed three items just outside the door to our garden: her favorite perch, the accustomed feeder, and some fuchsia sprigs. Then we opened the door. At first she zoomed up several feet and snared a tiny insect. Then, after a sip of sugar water from her feeder, she flew to the upper branches of our lemon tree. Soon she took her first bath in a shallow pie-pan with a roughened bottom, something which she had refused to do in the house.

She stayed around the back yard for the first few days. If we held aloft her test-tube of colored sugar-water and called "Thumbelina," she would dash up at full speed. Spreading her tail wide and using it as a brake, she would hover and feed on the wing. Such responses became less frequent. She remained our garden guest for about ten days, then flew off to join her own kind.

After 33 days as our guest Thumbelina was gone, but she had awakened in us a permanent fascination with the smallest birds in the world. □

---

*Ivan Barker lives in Novato, California, just north of San Francisco.*

# DAYFLOWERS

By Robert Faden, assistant curator of botany

Throughout the summer the half-inch-wide, blue flowers of the common dayflower (*Commelina communis*) appear in weedy places in cities and rural areas of the eastern United States. Each delicate blossom remains open only a few hours—hence, the name "dayflower"—after which it disintegrates into a pulpy mass. As the flower begins to collapse, the pollen produced by the anthers comes into contact with the stigma, resulting in self-pollination—unless the flower has been previously visited by pollinating insects. The pollinated flower gives rise to a small, dry fruit containing up to five seeds. These seeds are able to endure our coldest winters, and produce a new crop of dayflower plants the next spring.

The common dayflower was given its scientific name in 1753 by Linnaeus, the father of modern plant and animal classification. For the genus he used *Commelina,* a name coined by the French missionary, explorer, and botanist Charles Plumier in 1703 to honor two Dutch botanists, Jan Commelijn and his nephew Caspar. It has been suggested that Plumier chose to honor *two* botanists because dayflowers usually have only two large petals. The specific name *communis,* meaning "common," was added by Linnaeus.

Throughout the world, but mainly in the tropics, there are more than 200 kinds of dayflowers. Most have blue flowers, but some may have lavender, lilac, peach, buff-orange, yellow, or white flowers, depending on the species. Five species, including the common dayflower, occur in the United States, chiefly in the east and south. All usually have sky-blue flowers, although an occasional plant may produce lavender flowers.

The flower structure of dayflowers is distinctive. Two large, equal petals with abruptly narrowed bases are held upward; the third petal, usually very reduced but sometimes as large as the other two, faces down. The three lower stamens are fertile and produce pollen. The upper stamens are sterile, and their anthers are modified into characteristic four-lobed bodies which probably help to attract insect pollinators. Most flowers are hermaphroditic; that is, they contain both sexes. The female parts of a few, however, may be very reduced or entirely absent; these flowers, then, are staminate, or male.

The flowers of the dayflower and other members of the spiderwort family (Commelinaceae) are unusual in that they do not produce nectar. The bees and hover flies which visit them collect only pollen. It has been reported that bees pierce the lobes of the sterile anthers of the dayflower with their mouthparts and thus obtain liquid refreshment. However, this has not been observed in recent years, and careful studies of bee behavior on the flowers are needed.

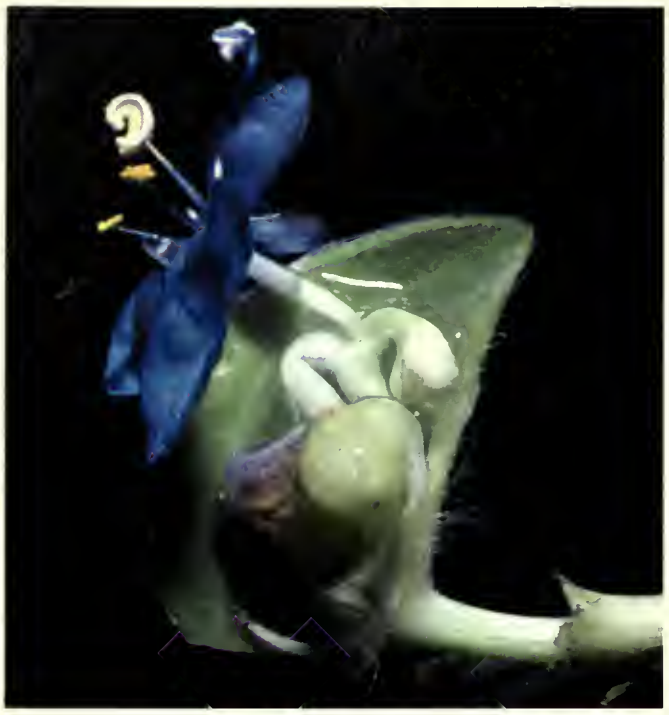
In a few species, special flowers which set seed but never open, are produced on short underground stems from the base of the plant. These are called *cleistogamous* flowers. They ensure a supply of seeds already planted in a place where that species has previously demonstrated its ability to grow and reproduce. The normal, above-ground flowers produced on the same plants, yield seeds which are useful for the dispersal of the species to new areas. However, many of these seeds—like those of any species whose seeds are dispersed in a rather random fashion—may end up in places unsuitable for the species, and thus be wasted. In the very dry region around Timbuctu in Mali, West Africa, the seeds produced by the subterranean flowers of a species of dayflower avoid the very high surface temperatures of the soil.

The buds and young fruits of dayflowers are protected from insect attack by being enclosed in a folded, modified leaf called a *spathe.* The buds are inclined downward. When they are ready to open, they curve forward and upward in order to allow the flower to clear the spathe. If the flower is pollinated, the flowering stalk bends backward and down, so that the young fruit is enclosed within the spathe but does not interfere with the unfolding of the later buds. If the flower is not pollinated, its stalk usually breaks off at the base within a few days. In some species of dayflower the spathe is funnelshaped and contains copious amounts of a slimy liquid which bathes the buds and young fruits, protecting them from desiccation. Such species are able to grow in very dry regions.

Dayflowers are used as human food or medicine or as fodder for livestock in many parts of the world. In Japan, China, Kenya, and other countries, whole dayflower plants or just the roots or leaves are eaten, after being boiled or steamed. Cooking is essential in order to destroy the needle-sharp calcium oxalate crystals, called *raphides,* which are present throughout the plant. A variety of medicinal uses have been reported. The leaves are used by the Malays for poulticing sores; in Bolivia and Kenya the liquid from the spathes is used to treat eye infections; a decoction of dayflower plants and other species is used to treat barrenness in women by the Sotho in southern Africa. The writer is unaware, however, of any dayflower extracts having been tested clinically.

The spiderwort family also includes our native spiderworts (*Tradescantia* species) and such familiar cultivated plants as the wandering Jew (*Zebrina pendula* and *Tradescantia* species); Moses-in-the-cradle, or oyster plant (*Rhoeo spathacea*); and Tahitian bridal veil (*Gibasis schiedeana*). These cultivated species illustrate some of the problems in using common names: the same common name may be applied to more than one genus or species, for example, wandering Jew.; one species may have several common names; only two of the many common names for *Rheo spathacea* are mentioned here; the common name may be misleading—Tahitian bridal veil is indigenous to Mexico.

*Pages 24, 25: Dayflowers from around the world* ➤



Commelina zambesiaca *(Kenya). Front of spathe removed, showing buds and young fruit.*

Photos by Robert Faden

Commelina benghalensis *(Philippines), showing subterranean, cleistogamous flowers.*

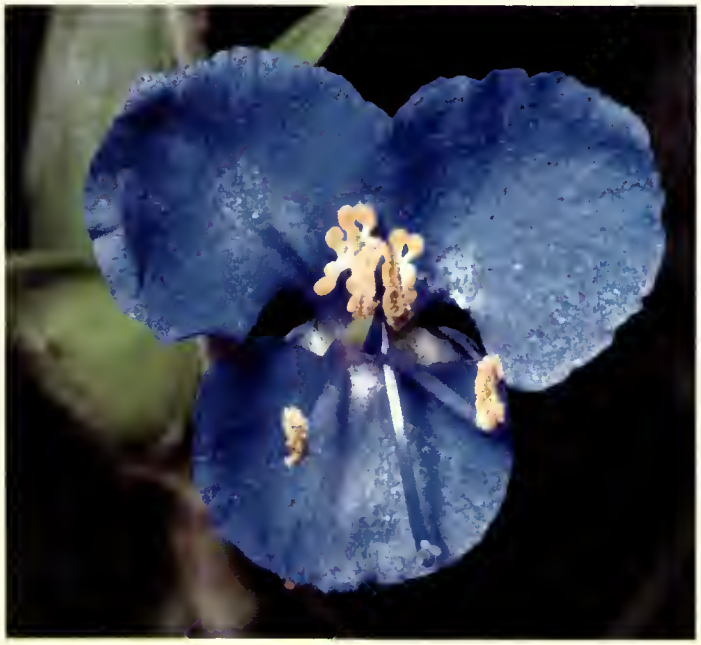
Commelina trilobosperma *(Kenya)*

Commelina communis *(Missouri). The common dayflower.*

Commelina benghalensis *(Sri Lanka). Hermaphroditic (below) and staminate (above) flowers.*

Commelina hockii *(Zambia)*

Commelina tuberosa *(Mexico)*



Commelina erecta *(Missouri)*

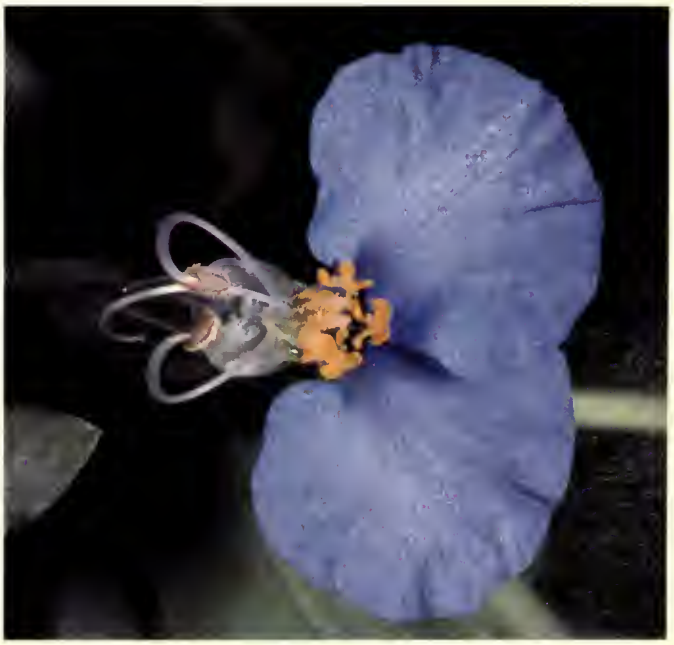


*Photo taken during 1977 Quetico trip* Glenn Whitmire

# *Quetico Wilderness Canoe Trip for Members*

**July 15 - 25**

QUETICO PROVINCIAL PARK, in western Ontario, is a mosaic of pure glacial lakes, pre-Cambrian rocks, and virgin boreal forest. Together with Minnesota's Boundary Waters Canoe Area, which it adjoins, this park is one of our continent's last remaining wilderness areas.

Field Museum is sponsoring for the fourth consecutive year, a canoe trip to Quetico for its high school-age members. The Voyageur Wilderness Program, of Atikokan, Ontario, is cosponsor. The ten-day trip is not primarily for fishing, nor is it a crash course in ecology; rather, it is intended as a wilderness experience and, as such, can mean different things to different participants. To truly experience wilderness is to forsake many of the comforts and crutches of civilized life. It means hard work—paddling long hours and carrying canoes and gear over portage trails that range from a few yards to more than a mile long. But it also means entire days during which one's group will encounter no others; it means lakes clean enough to drink from; it means periods of intense silence and opportunities to see wild animals and to experience the northern lights.

The group of 30 will be divided into single-sex units of five or six persons, each with a counselor or guide. All equipment, food, and guide services, as well as bus transportation between Field Museum and Quetico are included in the trip cost: $215.00. Applicants must be between 14 and 19 years old. Previous camping or wilderness experience is not necessary. The prime qualifications are proven swimming ability, good health, maturity and reliability. All applicants will be interviewed by Field Museum counselors; the deadline for applications is May 25. Those chosen for the trip will be so notified by June 2.

Slide presentations by Voyageur Wilderness Program representatives will be given on Field Museum's Members' Nights, May 15, 16, 17, and 18. Program times and location will be announced in Members' Night literature or may be obtained by phoning 922-9410, X-362. For an application or additional information, phone or write Julie Castrop, Department of Education, Field Museum, Roosevelt Road at Lakeshore Drive, Chicago, Il. 60605.

# *April and May at Field Museum*

*(April 15 through May 15)*

### New Exhibits

**Locks from Iran: A Key to a Culture**—opens April 29. A unique exhibition of 463 locks from Iran, surveying sixteen centuries of lockmaking, comes to the United States from the people of Iran under the patronage of her Imperial Majesty Farak Pahlavi, the Shabanou of Iran. Most of the padlocks are handmade; many resemble human and animal figures; all demonstrate the significance of locks to the Iranian people as means of security, cultural symbols, and artistic expressions. The exhibit is being circulated by the Smithsonian Institution Traveling Exhibition Service (SITES). Through July 30.

**Folk Art in China**— A special temporary exhibit of approximately 150 utilitarian and symbolic objects dating from the mid-15th to the 20th century. Each artifact expresses the underlying characteristic of its period. Included in the exhibit are: bamboo furniture, woodlock prints, textiles, tile engravings, folk paintings, baskets, paper crafts, statues, and lacquered leathers and metalwork. On loan from the University of Hawaii, this exhibit is dedicated to Chinese-Americans in celebration of the U.S. Bicentennial. Hall 27. Through July 5.

**Peru's Golden Treasures.** A dazzling collection of 225 pre-Columbian gold artifacts, on loan from the Museo Oro del Peru, Lima, comprises the largest collection of its kind ever shown in the United States. Augmenting the Museo Oro del Peru pieces, which survived the Spanish conquest of Peru in 1532, are more than 50 antiquities from Field Museum's own collections and from those of the Peabody Museum at Harvard. Hall 26. Through May 21.

### New Programs

**Ayer Illustrated Lecture Series**—Saturdays, through April 29, at 2:30 p.m. Enjoy an adventurous but relaxed afternoon touring the world while comfortably seated in the museum's Simpson Theatre, ground floor west. Doors open at 1:45 p.m. A limited number of reserved seats are available for Members on days of the lectures until 2:25 p.m.

| | |
|---|---|
| April 15 | *Portraits of Brazil*<br>by William Moore |
| April 22 | *To Spot a Zebra*<br>by Quentin Keynes |
| April 29 | *Mexico: Legend of the Lost Crown*<br>by Howard and Lucia Meyers |

**Ray A. Kroc Environmental Education Field Trips.** Beginning May 6, the Museum offers its spring series of weekend environmental field trips to areas in and around the Chicago area. Watch your mailbox for a copy of the environmental field trips flyer. Advance registration is required.

**Members' Nights—May 15, 16, 17, 18.** Field Museum's famous behind-the-scenes open house is to be held this year on four consecutive evenings. From 6 p.m. to 10 p.m., the Museum offers a myriad of activities—special displays, lectures, games, tours, and demonstration—especially for Members. An invitation will be mailed to all Members.

*Calendar continued on back cover*

*On view in "Folk Art in China" exhibit: kidney-shaped padlock, province of origin unknown; 19th century; height 2 inches (5.1 cm). The Chinese characters read "Prosperity for five generations."*

# *April and May at Field Museum*

*CALENDAR continued from inside back cover*

### Continuing Exhibits

**Field Museum Gamelan.** Field Museum's 19th-century Javanese gamelan, an ensemble of 24 fine bronze and wood musical instruments, has been completely restored for exhibition. It is the oldest and perhaps finest gamelan outside Indonesia. Hall 5, ground floor.

**Pawnee Earth Lodge.** This permanent exhibit in Hall 3 is a traditional Pawnee earth lodge—the home and ceremonial center of Pawnee Indians as it existed in the mid-1800s. Daily programs provide opportunities to learn about Pawnee culture. Public program hours: Monday through Friday, 1:15 p.m., weekends, 11 a.m. and 1:15 p.m. Tickets may be obtained 15 minutes prior to the program at the north information booth. Programs limited to 30 people.

**The Place for Wonder.** This gallery provides a place to handle, see, and compare artifacts and specimens. Weekdays 1 p.m. to 5 p.m., weekends 10 a.m. to noon and 1 p.m. to 5 p.m. Ground floor, near elevators.

**Male and Female: Anthropology Game.** The exhibit where visitors become anthropologists. Discover that economic and social roles of the sexes are not universally the same. Ground floor, near elevators.

### Continuing Programs

**Discovering the Moche**—Fridays and Sundays through May 21, at 11 a.m. and 2 p.m. Short documentary film interprets the symbolism in pottery designs made by Peruvians 1,000 years before the Incas. Shown in connection with the *Peru's Golden Treasures* exhibit. Simpson Theatre, ground floor west.

**Painted Pictures**—Fridays and Sundays through May 21, at 11 a.m. and 2 p.m. Short documentary film surveys the modern Peruvian Aymara Indians who continue to live like their pre-Columbian ancestors. Shown in connection with the *Peru's Golden Treasures* exhibit. Simpson Theatre, ground floor west.

**Lords of the Labyrinth**—Saturdays through May 20, at 11 a.m. Newly released IMAX production features new developments in recent archaeological fieldwork by Field Museum anthropologists on the north coast of Peru. Shown in conjunction with the *Peru's Golden Treasures* exhibit. Simpson Theatre, ground floor west.

**Spring Journey for Children: Exploring the Ancient Andes**—through May 31. Free self-guided *Journey* leads children and families through museum exhibits to learn about the lifestyles of ancient Andean cultures. *Journey* pamphlets are available at the information booth, main floor.

**On Your Own at Field Museum.** Self-guided tour booklets, adult and family-oriented, available for 25¢ each at entrance to the Museum Shop, main floor north.

**Weekend Discovery Programs.** Guided tours, demonstrations, and participatory activities. Every Saturday and Sunday, 10 a.m. to 3 p.m.

**The Ancient Art of Weaving.** Demonstrations every Monday, Wednesday, and Friday, 10 a.m. to noon. South Lounge, 2nd floor.

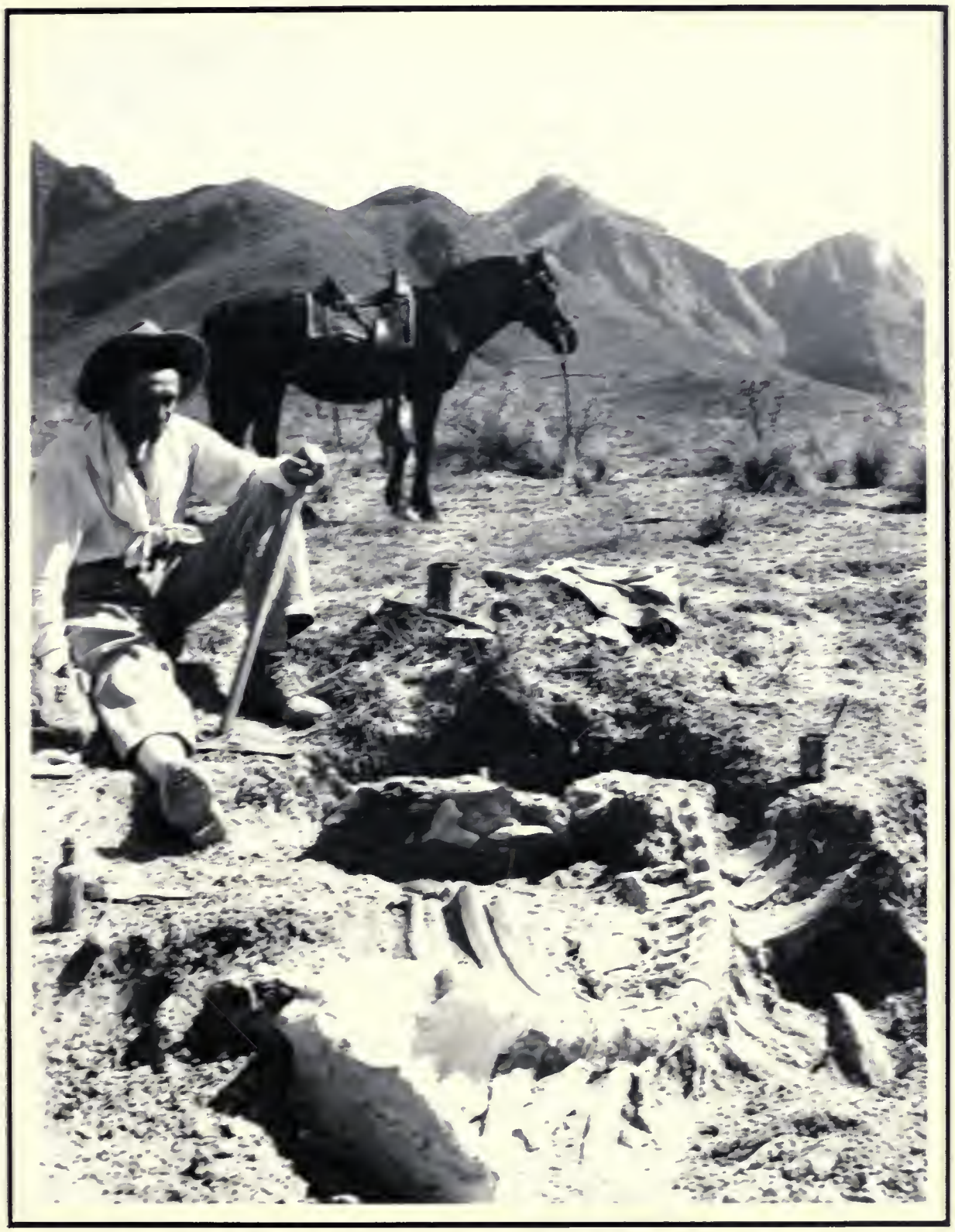
**Audio Information System.** The museum's newly installed audio system, Cinguide, enables visitors of all ages to visit selected exhibits in any sequence. Audio receivers and maps available for $2.25 per person, $3.75 for a family of up to five at the entrance to the Museum Shop, main floor north.

### April and May Hours

**The Museum Opens** daily at 9 a.m. and closes at 5 p.m. through April, every day except Friday. In May, except on Fridays, the Museum closes at 6 p.m. On Fridays, the museum is open to 9 p.m.

**The Museum Library** is open weekdays 9 a.m. to 4 p.m. Obtain a pass at reception desk, main floor.

**Museum telephone:** (312) 922-9410.



# MEMBERS' NIGHTS
# May 15, 16, 17, 18

**Field Museum of Natural History Bulletin**

May 1978
Vol. 49, No. 5

*Editor/Designer:* **David M. Walsten**
*Production:* **Oscar Anderson**
*Calendar:* **Nika Semkoff Levi-Setti**
*Staff photographer:* **Ron Testa**

**Field Museum of Natural History**
Founded 1893

*President and Director:* **E. Leland Webber**

BOARD OF TRUSTEES

William G. Swartchild, Jr., *chairman*
Mrs. T. Stanton Armour
George R. Baker
Robert O. Bass
Gordon Bent
Harry O. Bercher
Bowen Blair
Stanton R. Cook
O. C. Davis
William R. Dickinson, Jr.
Thomas E. Donnelley II
Marshall Field
Nicholas Galitzine
Paul W. Goodrich
Hugo J. Melvoin
William H. Mitchell
Charles F. Murphy, Jr.
James J. O'Connor
James H. Ransom
Mrs. Joseph E. Rich
John S. Runnells
William L. Searle
Edward Byron Smith
Robert H. Strotz
John W. Sullivan
Edward R. Telling
Mrs. Theodore D. Tieken
E. Leland Webber
Julian B. Wilkins
Blaine J. Yarrington

LIFE TRUSTEES

William McCormick Blair
Joseph N. Field
Clifford C. Gregg
Samuel Insull, Jr.
William V. Kahler
Remick McDowell
James L. Palmer
John T. Pirie, Jr.
Donald Richards
John M. Simpson
J. Howard Wood

CONTENTS

3 **Field Briefs**

4 **New Guinea Adventure**
Sketch of a working anthropologist
*By Susan B. Parker*

9 **Folk and Fine Arts of China**
Roundtable Discussion

10 **Our Environment**

13 **Members' Night**
May 15, 16, 17, 18

16 **Bolivian Adventure**
In search of the bones of giants
*By Larry G. Marshall, visiting curator, Department of Geology*

24 **The Versatile Gourd**
*By Alfreida Rehling*

25 **Field Museum Memorial Fund**

26 **Books**

27 **May and June at Field Museum**
Calendar of coming events

COVER

José Strucco contemplates partially excavated ground sloth, *Scelidotherium*, near Padcayá, Bolivia, in 1924. The find was made during phase II of the Marshall Field Paleontological Expedition to South America, the subject of "Bolivian Adventure," by Larry G. Marshall, page 16. Strucco served as expedition guide, assistant, and troubleshooter for Field Museum paleontologist Elmer S. Riggs (1869-1963), who headed the expedition. For another view of *Scelidotherium*, see page 23.

*Field Museum of Natural History Bulletin* is published monthly, except combined July/August issue, by Field Museum of Natural History, Roosevelt Road at Lake Shore Drive, Chicago, Il. 60605. Subscriptions: $6 a year; $3 a year for schools. Museum membership includes *Bulletin* subscription. Opiniona expressed by authors are their own and do not necessarily reflect the policy of Field Museum. Unsolicited manuscripts are welcome. Postmaster: Please send form 3579 to Field Museum of Natural History, Roosevelt Road at Lake Shore Drive, Chicago, Il. 60605. ISSN: 0015-0703.

*Field Museum volunteers Hermann C. Bowersox and William E. McCarthy assisted in the editorial preparation of this issue.*

# FIELD BRIEFS

*William G. Swartchild, Jr. (rt.), chairman of Field Museum's board of trustees, receives the Chicago Convention and Tourism Bureau's first Chicago Visitor Promotion Award in recognition of the Museum's "outstanding performance in promoting the King Tutankhamun exhibit during the summer of 1977." Presenting the award at the March 9 ceremony is James J. O'Connor, chairman of the bureau. O'Connor is president of Commonwealth Edison Company. In addition to local viewers, about 300,000 out-of-town visitors saw the Tut exhibit. The University of Chicago's Oriental Institute, cosponsor of the exhibit, also received the Chicago Visitor Promotion Award.*

**May and June Field Trips**

One-day field trips are again being offered by Field Museum in May and June to locales of special biological or ecological interest. Trip destinations include Indiana Dunes, Palos Forest Preserve, Matthiessen State Park, Volo Bog, Moraine Hills State Park, Illinois Beach State Park, Warren Woods, the Des Plaines Valley, Bailly Homestead, Cowles Bog, Chiwaukee Prairie, Ryerson Conservation Area, Gensburg-Markham Prairie, and Gooselake Prairie State Park. Each trip is led by one or more specialists in the biology, geology, or ecology of the area.

While many of the trips are limited to persons 18 and over, others are designed with content and activities appropriate for children as well as adults. Registration, per trip, is $7.00 for members, $8.00 for nonmembers, $3.50 for children. Each trip will depart Field Museum by chartered bus at 8:00 a.m. and return between 3:00 and 5:30 p.m. All participants must travel by bus and are asked to provide their own food and beverage for the day's outing.

Because of the popularity of this series, registration is limited to two trips per person and early registration is advised. Brochures are available by writing: Environmental Field Trips, Department of Education, Field Museum, Roosevelt Rd. at Lake Shore Dr., Chicago, Ill. 60605.

These trips are part of Field Museum's Environmental Education Program, which is partially funded by a gift from Mr. and Mrs. Ray A. Kroc.

*Continued on page 26*

# NEW GUINEA ADVENTURE

## Sketch of a Working Anthropologist

**By Susan B. Parker**

"I have not the slightest idea in what territory you are working and I do sincerely hope you will make a good clean up, leaving scarcely anything for . . . the enemies."

Is the above (a) a letter from a guerrilla chief to one of his regional lieutenants, (b) a church official's advice to one of his missionaries, (c) a note from the head mobster to one of his local henchmen, (d) a museum curator's letter to an anthropologist in the field?

If you guessed (d) give yourself 10 points in museum history. In the early part of this century, collecting specimens for exhibition was a hotly contested activity among the world's major museums. The competition for "oddities" was keen. Collectors, in their eagerness to amass large collections for show, were sometimes un-

---

*Susan B. Parker, a volunteer in the Department of Anthropology, served in the South Pacific with the Peace Corps.*

◄*The canoe that carried curator Albert Lewis (inset) along the coast of German New Guinea.*

scrupulous in their dealings with the natives as well as with one another.

Albert Buell Lewis (1867-1940), appointed assistant curator of African and Melanesian ethnology in 1907, was actively engaged in enlarging the collections of Field Museum. It is to his credit, and that of Field Museum, that he accomplished this collecting task with a measure of fairness and professionalism not often shown by collectors of that time.

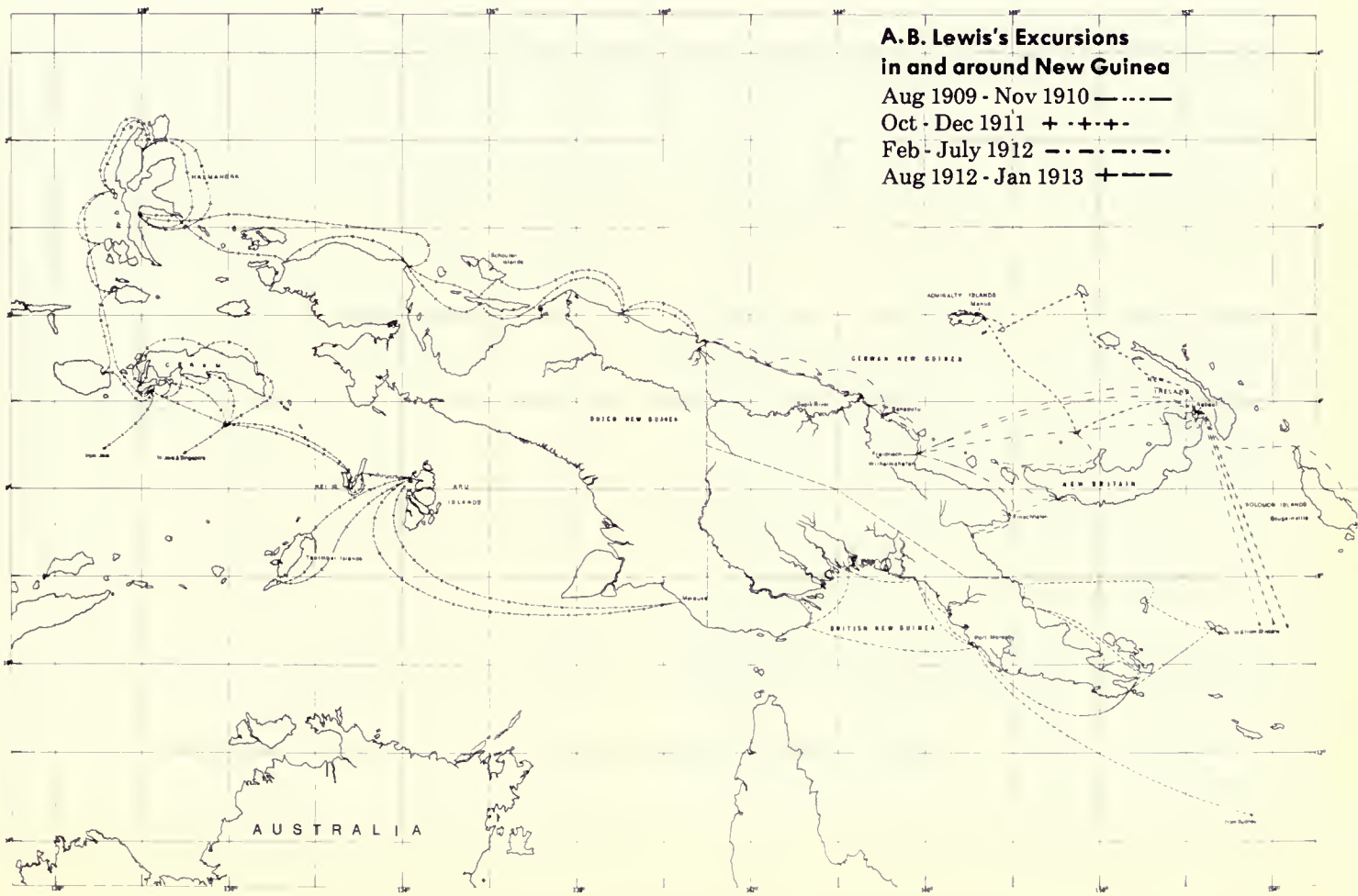
In 1908 George A. Dorsey, then Field Museum's chief curator of anthropology, made a quick collecting trip around the world, stopping briefly in German New Guinea. He was impressed by the opportunities there for "ethnological investigation" and wrote to Frederick J. V. Skiff, Field Museum's director: "Where else can so great and valuable a mass of museum material be secured at such a reasonable expenditure of money. . . . The natives are willing to part with the objects of their material [culture] in exchange for the cheap knives, hatchets, axes, adzes, beads, looking glasses, etc., of German manufacture . . . . The conditions there are absolutely ideal for museum collecting."

The response at Field Museum was to organize and fund the Joseph N. Field South Pacific Expedition of 1909-13. Lewis was chosen to head the expedition. He was also to be the expedition's photographer, collector, cataloger, ethnologist, and freight-handler. Through Lewis's talents and energies, the Museum hoped to acquire the world's most extensive collection of New Guinea and South Pacific artifacts.

Lewis did not disappoint them. By the time he had completed his work three years later in German, British, and Dutch New Guinea and other South Pacific islands, he had collected nearly 300 cases containing about 12,000 ethnological specimens—everything from shell beads to full-sized canoes.

Lewis beat the Museum für Völkerkunde (at Leipzig) to a large collection of new material from the Admiralty Islands. (The Germans were so incensed that they threatened litigation.) But they and collectors from other museums beat Lewis to significant acquisitions elsewhere, notably in British and Dutch New Guinea.

Lewis preferred to do his own collecting—dealing with the natives himself; but occasionally in areas too remote to visit personally, he deputized European planters or missionaries to collect for him. He did not limit himself to collecting showy specimens for museum exhibition, but tried to acquire a variety of artifacts that



would "illustrate the sum total of the life and achievements of a people." He made copious notes and took hundreds of photographs of native life throughout New Guinea. He made a concerted effort to understand how the specimens he acquired fitted into the cultures of these people; and he did all of this under the most trying conditions.

Transportation was a big problem for him, as it is today for most field workers in remote areas. In German and British New Guinea, Lewis had to depend on irregular government and missionary boats to carry both him and his artifacts to and from his collecting bases. From each base he would explore the surrounding areas on foot or by native canoe.

At one point during his year in German New Guinea, the Germans, who were outraged by an unfavorable article of George Dorsey's in the *Chicago Tribune*, refused to provide him with transportation. But just as Lewis was beginning to despair of accomplishing any further work there, a German government ship arrived under the command of a new captain who knew nothing of the travel ban against him. Fast-talking himself aboard, Lewis secured passage up the Sepik River, an area where he was especially eager to collect. In similar fashion, Lewis managed to get around for four years, although he could not always arrange the time or support necessary to investigate an area as thoroughly as he desired.

The fact that Lewis took pictures was rather innovative for his time. He employed photography extensively to document how artifacts were used in daily life. He also photographed step-by-step techniques of crafting articles. But taking pictures was not as easy then as it is in today's pushbutton era. Lewis's equipment was heavy and cumbersome, yet fragile, and this posed a logistical problem in itself. He had a tripod-supported view camera that used glass plates instead of film. Then there were the developing tanks, chemicals, and related paraphernalia—easily a trunkload of gear to haul around with him.

He had the usual problems encountered by nonprofessional photographers such as focus and exposure; and he also had to put up with difficulties imposed by the climate. Fresh water, essential for developing, was scarce or unavailable in many areas. If it was available, the water was often too warm for the chemical reactions, and Lewis would have to wait night after night before conditions were cool enough for processing his negatives. The high temperature and humidity favored the deterioration

*In German New Guinea, Lewis's camera records ceremonial procession of men adorned with feather masks.*

of chemicals and encouraged the growth of fungus and mold in his camera and on his lenses. Yet Lewis persisted, and he was able eventually to bring back an important visual record (including the photographs reproduced here) documenting a now vanished way of life.

The collecting of specimens was never a simple matter. Some regions had been practically cleaned out by the German, Dutch, British, or Chinese collectors who had gone before him. In a few places the people were eager to part with objects and would even try to sell him worthless junk. In still other places the natives were beginning to recognize the significance of their own material culture and were hesitant to part with possessions. Some objects had strong taboos associated with them, and their owners were reluctant to let Lewis have them for fear that the taboos would be violated. Other objects were considered too much a part of the identity of a group to be exchanged for a few trinkets or steel knives, and the prices they demanded for these items were beyond Lewis's means.

In his diary, Lewis recounts an incident that graphically illustrates the kinds of frustrations, obstacles, and

*Three dancers, each with his pipe, pose for Lewis in British New Guinea.*

rewards he often experienced. He set out one morning in search of a village called Banaputu where, he had been told, pots were made. When Lewis and his two guides finally arrived at Banaputu, they found it deserted. A guide then said that there were at least three other Banaputus—one down the coast, one in the foothills, and one on the coastal range.

Lewis decided to make for the foothill Banaputu, but soon discovered that an attempt had been made to conceal the path leading to that village by felling trees across it and covering it with brush. Eventually they succeeded in locating the village, only to find it, too, deserted. But they had arrived just in time to see some of the men running away. Too dedicated and stubborn to give up now, Lewis sent one of his guides on ahead to track the villagers, while he struggled along behind. When at last they caught up with the villagers, a curious change had taken place. The villagers were now ready to cooperate, and one of the women set to work and made a pot while Lewis photographed the process.

As he accumulated specimens, Lewis had to tackle the problem of getting them ready for the 10,000-mile ride back to Chicago. Adequate packing materials were seldom available, obliging Lewis to build the crates himself out of bamboo and various odds and ends he was able to scavange. As a result, some objects, especially pots, were broken in transit to Field Museum, but most came through unharmed.

Lewis's living conditions left much to be desired. Whenever possible, he secured lodging with European planters, missionaries, or government officials; but as often as not, he had to be content with the hospitality of native villagers. They would give him space to set up his cot, usually in the men's house, but this had two drawbacks. The night-long conversations there often kept him awake, and corpses were sometimes kept there to decompose before final disposal, so that more than once he had to sleep with a decomposing body nearby.

His health was none too good at times. He suffered recurrent bouts of fever, probably malaria, that would inactivate him for several days, often during some important festival. He was gravely ill with blackwater fever for six of the eight weeks he spent at his final collecting base at Merauke, Dutch New Guinea.

After three years in the field, Lewis had done all the collecting he could with the time and funds provided by the Museum; he was weary and ready again for the comforts and amenities of life back in the states. He also faced the monumental task of sorting and cataloging his thousands of specimens and of preparing them for exhibition. But he had accomplished the task he had set out to do—amassing an extraordinary collection that remains one of the most significant in the world. It was an amazing single-handed achievement, done with a kind of integrity, fortitude, and understanding that was rare among collectors of that era. □

*Modes of dress in New Guinea early in 20th century.* Above left: *man in dancing regalia;* above right: *woman in mourning;* below: *man with elaborate coiffure.*

*The collecting of Albert B. Lewis in the early 1900s was, by the standards of the day, both ethical and scientifically responsible. In recent years, however, scientists and nonscientists alike have become concerned about preserving not only endangered species of plants and animals but also those ancient sites and recent artistic and religious traditions that are threatened by overzealous collectors: art dealers, private individuals, and museum workers. Field Museum's acquisition policy, below, has also served as a model for the acquisition policies of other museums.*

**Policy Statement of Field Museum Concerning the Acquisition of Antiquities and Ethnographic Materials**

1. (a) The Museum will not acquire any archaeological or ethnographic object that cannot be shown to the satisfaction of the Museum official or committee responsible for its acquisition to have been exported legally from its country of origin.

(b) Further, the Museum will refuse to acquire objects in any case where the responsible Museum official or committee has reasonable cause to believe that the circumstances of their recovery involved the recent unscientific or intentional destruction of sites or monuments. These restrictions shall also apply to archaeological objects excavated in the United States.

(c) "Acquire" shall include acquisitions through purchase, gift, or bequest. "Country of origin" means both "country of ultimate origin," when the objects in question have been recently transported across several international boundaries, and also "country of intermediate origin," when applied to objects anciently transported and then deposited in an archaeological or historical context.

(d) This Museum policy shall be taken into account in determining whether to accept loans for exhibition or other purposes.

2. This Museum policy shall apply especially to objects of appreciable market value. The pedigrees of such items will be subjected to particular scrutiny. Regardless of value, however, no archaeological or cultural object of any kind will be acquired unless the responsible Museum official or committee is satisfied as to the legality of its exportation and the circumstances of its recovery.

3. The Museum will hereafter acquire no questionable objects except those that can be demonstrated to have left their country of origin before the approved date of this document.* The same date shall apply as to the acquisition of objects reasonably believed to have been illegally or unscientifically excavated within the United States. The responsible Museum official or committee shall be entitled, however, to utilize the principles contained in this Policy Statement in determining whether to acquire any object reasonably believed to have been improperly exported or recovered before that date.

4. The Museum has for many years refused to appraise archaeological objects. Extending this policy, the Museum shall hereafter refuse to authenticate any antiquity the acquisition of which by the vendor or owner does not meet the criteria listed in paragraphs 1 and 3. In this manner the Museum hopes to avoid encouraging, even indirectly, the trade in illicit or irresponsibly recovered antiquities.

5. In the future, if the Museum should inadvertently acquire an object that is thereafter determined by the responsible Museum official or committee to have been exported or recovered in violation of this policy, the Museum shall promptly return the object to the transferor or, whenever appropriate, to the government of the country of origin or other proper owner thereof, as the case may be.

*July 17, 1972

# *Folk and Fine Arts of China*

## Roundtable Discussion

Saturday, May 13

"Chinese Art" most often connotes beautifully designed, exquisitely fashioned, and prohibitively expensive *objets d'art*. Almost exclusively, such pieces were intended for prerevolutionary China's top social echelon. However, another large class of art objects, often of great artistic merit, were made by and for those with neither formal education nor wealth. This is the folk art of China.

In a roundtable discussion—in conjunction with the current exhibit on Chinese folk art in Hall 27—three distinguished art historians will explore the relationship between the fine art and folk art traditions of China: Tseng Y.-H. Ecke, professor of art history at the University of Hawaii; Jack Sewell, curator of Oriental art at the Art Institute of Chicago; and Harrie Vanderstappen, professor of art at the University of Chicago. Roundtable moderator will be Bennet Bronson, Field Museum's associate curator of Asian archaeology and ethnology. Time and place: Field Museum's James Simpson Theatre, Saturday, May 13, 1:30 to 4:30 p.m. Color slides will be shown and coffee will be served.

Admission for members, payable at the door, is $2.00; for nonmembers, $3.00. For additional information, call 922-9410, ext. 363.

# OUR ENVIRONMENT

### Harp Seal Quota up for 1978

Each spring for 200 years Canadians and Norwegians have hunted harp seals on the ice off Newfoundland's coast. Last March was no different, for that was when the newborn harp seal pups were cloaked in their desirable furry white coats. Because of the methods used and the numbers of seals killed, it has been called "the greatest mass slaughter" of any wild mammal. But this year, with more information about the seal population and better control of methods, even some long-standing foes of the hunt have changed their minds, reports the National Wildlife Federation.

A delegation of Canadian officials has been spreading the word throughout the U.S. that the seals are being killed humanely and in numbers that allow the population to grow. The Canadian government set a quota of 180,000 seals to be taken this year. About 80 percent will be pups, preferred for their white fur, which is made into fashionable coats and accessories. Although hunted primary for their coats, half of the income from the seal catch also comes from the sale of the meat and oil. The seal flippers, which retail for $2 each, are considered a delicacy by the Newfoundlanders. The total value of the 1976 seal hunt to the Atlantic regional economy was estimated at $5.5 million.

In the shorter, cooler days of fall tens of thousands of harp seals begin moving to the southernmost limits of their range in the North Atlantic, ahead of the advancing ice. Along the way the pregnant females eat tons of capelin, cod, and crustaceans, building up a two-inch layer of blubber to protect them from the cold and to carry them through whelping (giving birth) and nursing. In late February and early March the females go out onto the rough ice floes and, in this frozen cradle, known as whelping ice, give birth to their pups. For two and a half weeks the "whitecoats," as the newborn pups are called, nurse on their mothers' fat-rich milk. The mother stays close by her crying pup, knowing it by its own distinctive individual smell and sound.

After three weeks the rotund pups are weaned, and the mothers abandon them. The pups, if they survive the crushing upheavals of the ice and the annual spring hunt, will drift with the ice and swim untold distances to their summer feeding grounds off the southwest coast of Greenland. At this point, these "beaters," which have molted their soft, white natal wool into a spotted grey coat, continue this cycle which has evolved through generations of adaptation.

The annual seal hunt is a part of this life story. Although historically it was imbued with a sense of adventure, courage, and romance, in reality the seal hunt was (and is) incredibly hard work under frequently harsh conditions. Stories are told of men who ate the hearts of the seal—raw—because it was the only food they had.

The seal hunts reached their height in 1831, when Newfoundland sealers reportedly returned with 686,000 sculps, seal skins with the underlying layer of blubber. After World War I, sealing declined but business soared again after the second World War. Demand for pelts was high, and modern methods brought the annual harvest to more than a quarter of a million. During the 1950s and 1960s, the seal population dropped by at least 60 percent.

Until 1971 sealers could take as many seals as they could get. Finally, international pressure pushed the government into paying more attention to the seals' numbers and, especially because of public protests over the cruelty of the hunt, placing some constraints on the killing methods. From 1971 through 1974 the catches were always below the total allowed. But in 1975 and 1976 the quotas were exceeded, mainly because the land catch had increased through expanded use of small vessels. Last year the catch was slightly less than the quota.

Although the International Commission for the Northwest Atlantic Fisheries (ICNAF) has set the quotas in the past, Canada will now assume responsibility since it extended its fisheries jurisdiction to 200 miles off its coast in 1977.

Helicopters carrying the sealers to the ice have been banned since the 1960s, the number of seals that large vessels can take is limited, and no adult harp seals can be killed on the breeding patches. Scientists and veterinarians have said that of all the killing methods, clubbing with a hardwood bat appears to bring the swiftest and least painful death. Also, a Norwegian instrument, the *hakapik*, a hooked bat, was tried out in one area and found more effective in killing than the regular bat. Fisheries officers are supposed to explain humane killing methods to the sealers, who are issued an identification badge before they are allowed to hunt. Experienced sealers guide the novices, and several organizations send observers on the hunt.

The Canadian government has been photographing the seal concentrations from the air, using ultra-violet film which allows the white pups to show up on the snow. A complete photographic survey of the pups in 1977 resulted in an estimate of actual pup production of 330,000, a birth rate high enough to allow the seal population to grow, according to scientists. Information on growth of the individual animals was obtained by counting layers in the seals' teeth, much as tree rings are examined to learn the age of trees. Mortality rates were calculated by studying the ages of animals in the catch and the number that die naturally.

Using all these methods, the Canadian government, through ICNAF, states that the harp seal population is increasing and has been since 1972-73. The total population, excluding pups, is about 1.2 million and should rise to about 1.6 million in the next decade. Assuming that quotas of 190,000 to 215,000 are maintained, the populations should stabilize, the government says.

Not everyone is convinced, however. Despite attention to the killing methods and the Canadian government's increased efforts to count harp seals, some groups continue to oppose the hunt. One in particular, a Vancouver-based group called Greenpeace, says the seals' numbers actually are declining. Based on a Swedish study, it

maintains that the population is dropping by 17,000 seals annually and could face extinction in about 50 years. However, seal scientists who have evaluated this study found that even though it was based on data supplied by ICNAF's working group on seals, it contains numerous erroneous assumptions and arithmetical errors.

Aside from the scientific opinion, however, part of the opposition to the hunt certainly centers around those irresistible, huge, round, sad brown eyes of the pups, nestled in a background of white, which arouse so much human emotion. And the hunt is especially difficult to justify for those who do not believe in killing an animal for the sake of someone's fur coat or accessories.

The U.S. Marine Mammal Protection Act makes it illegal for anyone in the U.S. to participate in the seal hunt or to import any of the skins of the harvested seals. Further, no marine mammal (or the product of the mammal) younger than eight months or nursing at the time of taking may be brought in to the U.S. The American fur seal industry filed suit in January challenging this importation ban.

U.S. representatives (who are nonvoting members) to the ICNAF meetings have urged that ecological factors be considered along with economic ones in determining what to do about the seal hunt. In the future, the debate will likely continue. It is now largely up to the Canadian government to regulate the quotas, unless some sort of regional agreement is worked out for conservation of the seals. This would require more reliable scientific data than are presently available and a willingness of the nations involved to cooperate.

### Soil Erosion

Very subtly and without much public concern, the nation's soil resource is washing and blowing away, according to the Wildlife Management Institute. That means less food, less fiber, and less wildlife in the future. Soil is being washed away on the nation's cropland at an average rate of nine tons per acre per year, the institute reports. That is nearly twice the rate considered "acceptable" by soil conservationists. The soil loss rate was discovered by the Soil Conservation Service (SCS) in a new study of erosion and sedimentation.

In 1975, when data were collected, U.S. soil losses on cropland totaled 2.8 billion tons. More than 1.4 million acres of land were damaged by wind erosion in the Great Plains during the last two months of 1977, and more than 10.3 million acres may be damaged by wind erosion in the next few months, says the SCS.

### Carrier Pigeons: The Latest Paramedics

Devonport Hospital in Plymouth, England, foregoes taxi service for carrying crucial blood and tissue samples to the central laboratory two miles away and instead employs carrier pigeons, saving valuable time and money. The pigeons arrive at a designated cage, where they activate a bell and light signal. Never flying at night or in the fog, their perfect flying record of four minutes is attributed to their mates waiting at the lab.

### African Elephant Proposed as Threatened Species

The African elephant, the world's largest land animal, has been proposed for listing as a threatened species by the U.S. Fish and Wildlife Service. The species has declined in many parts of its range in recent years because of loss of habitat caused by an expanding human population and illegal killing for ivory. About 1,300,000 elephants are estimated to remain, but according to the Elephant Specialist Group of the International Union for the Conservation of Nature and Natural Resources, as many as 100,000 to 400,000 are being lost each year from ivory-poaching alone. Because there are still some large populations, however, some of which are stable and carefully protected, the Fish and Wildlife Service does not believe that the elephant is in immediate danger of extinction. For this reason, the service proposes to classify the species as threatened rather than endangered.

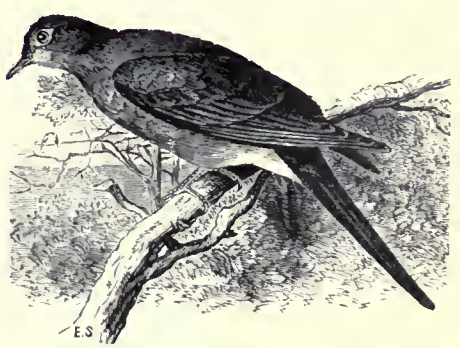
The elephant once occupied all of Africa, except for extremely dry areas. Today it occurs in 33 countries south of the Sahara, but it is progressively losing habitat in most of these areas as human settlements and farms expand. In western and southern Africa, the species has held out only in remote border areas or in small, isolated patches of suitable habitat. Many elephants are killed because they are considered a threat to man and his crops and settlements, and others die because the remaining habitat cannot support them. Certain elephant "population explosions" that have recently received publicity are often associated with forced crowding imposed by man, and actually result from humans encroaching on former elephant habitat, rather than the opposite. In any case, these occur only on a small percentage of the overall range of the species.

Because of its ivory, the elephant is one of the world's most commercially valuable species. Within the last few years, illegal killing has increased along with a tenfold rise in the price of ivory. Poaching appears to have been largely responsible for a drastic reduction of elephants in Uganda, and for eliminating nearly half of the elephants in Kenya, since the early 1970s. If large-scale poaching continues, the still large populations of elephants in eastern and central Africa could be further reduced, and the remnant populations in western Africa could be entirely wiped out.

### Demand Increases for Natural Rubber

In the early 1940s, the United States depended on the Malay peninsula for most of its rubber needs. When the Japanese occupied the peninsula, cutting off wartime rubber supplies needed for jeep, airplane, and truck tires, the U.S. quickly organized an Emergency Rubber Project at the California Institute of Technology. The project consisted of two parts: one to produce synthetic rubber from petroleum and one to produce natural rubber from guayule, a small shrub native to Mexico and Texas. Synthetic rubber production soon surpassed that of natural rubber, and the guayule program was abandoned.

However, cheaper and more easily produced synthetic rubber has been un-



able to replace natural rubber on the U.S. market. In fact, the U.S. imported 719,000 tons of natural rubber in 1974 alone, at a cost of more than $500 million. This represents over 30 percent of the total U.S. rubber consumption for that year. The World Bank recently predicted that by 1985 the demand for natural rubber will grow to three times the available supply and, as a result, a rubber crisis may loom in the future.

But why use natural rubber in the first place? Some people point to shortages and increasing costs of petroleum —a raw material essential to the production of synthetic rubber. Yet, even if petroleum were cheap and abundant, the demand for natural rubber would continue to increase because synthetic rubber is not as strong and elastic as its natural counterpart.

Synthetic rubber is fine for many commercial uses, but it will not last long in high stress items such as tire sidewalls. All tires have some percentage of natural rubber added to the synthetic base and the amount depends on the expected use. For example, ordinary automobile tires contain 20 percent natural rubber, while radials have about 40 percent. Radial tires have captured about half of the tire market, and this figure is constantly rising. Most bus and truck tires contain 40 percent natural rubber; tires for airplanes and large construction vehicles have nearly 100 percent. Add to these figures the fact that tires account for about 75 percent of all rubber used in the U.S., and it becomes obvious that natural rubber will be needed in increasing amounts.

Most natural rubber comes from the Asian rubber tree (*Hevea*) and is imported from the Malay peninsula and other areas of Southeast Asia. Studies have shown that *Hevea* is approaching its genetic limitations as far as the amount of rubber produced by a single plant. It is also in constant peril from a leaf blight which literally destroyed natural rubber production in South America. The political situation in Southeast Asia (currently a large producer) may make this area a questionable source of rubber in the near future. As a result, a recent National Academy of Sciences (NAS) panel has suggested that the U.S. develop its own source of natural rubber, and they referred to the guayule shrub as the best possibility.

Guayule (*Parthenium argentatum*) is a woody semidesert shrub which resembles sagebrush. It is native to north-central Mexico and southern Texas, prefers well-drained light soil, and will grow in areas of less than 15 inches of rain per year. The plant grows to a height of three feet, usually is harvested after four years, and will yield between 500 and 900 pounds of latex per acre (550-1000 kilograms per hectare). While rubber trees (*Hevea*) accumulate their latex in canals which are easily tapped, the guayule shrub's latex is found within the cells of the plant, and each cell must be ruptured to free the rubber. In the extraction process the leaves (which contain no rubber) are removed, and the rest of the plant is ground up and put in a highly alkaline vat of water. The rubber floats to the surface while the rest of the plant becomes waterlogged and settles to the bottom. The wormlike strands of rubber are then skimmed off and processed to remove other impurities such as resin and cork. Besides the rubber, other byproducts, such as wood fiber, resin, and wax, could be used. For instance, guayule leaves are covered by an easily extracted wax which is comparable to the highly sought after carnauba wax used in furniture polishes.

(CONTINUED ON P. 25)

*Processing* Hevea *rubber on backwoods plantation in Brazil.*

# MEMBERS' NIGHT

## *Field Museum's Open House for Members*

May 15, 16, 17, & 18

Chicago's big social event for May will, without a doubt, be Members' Night at Field Museum. This, at least, is the opinion of the Museum staff, which is busy preparing a "feast" of unusual displays, "live" exhibits, demonstrations, and intellectual games for Museum Members. From 6 to 10 p.m., on four successive evenings—May 15 through 18—Members will also see what goes on in the non-public areas: the laboratories, preparation rooms, collection storage areas (where more than 99 percent of the Museum's specimens are kept); they will also have an opportunity to chat with curators and other staff. Members will have their first real chance to see many building improvements that have been made in the past two years as part of the Museum's $25 million rehabilitation program.

All of this activity will, of course, be supplemented with food and drink, and the spacious grandeur of Stanley Field Hall will resound with the melodies of Peruvian musicians!

Since Members' Night first became a regular event, this is the first year that the open house will occur on four evenings—a move necessitated by the large increase in membership that has occurred in the past year. Identical programs will be offered on each of the four nights.

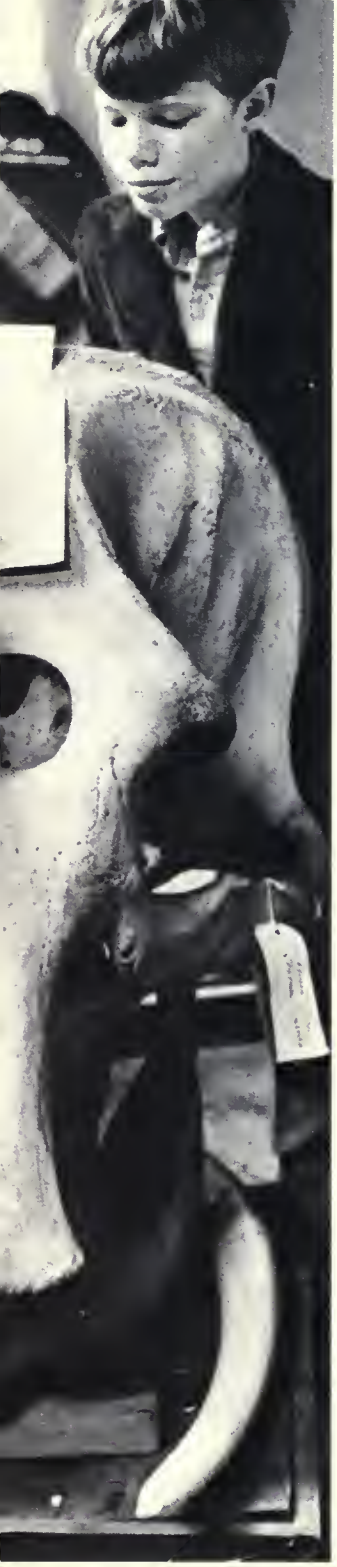
To promote an equal distribution of attendance on the four nights, Members are urged—though not required—to attend according to the following schedule: Those whose last names begin with letters A through D are asked to attend on Monday, May 15; E through K on Tuesday, May 16; L through R, Wednesday, May 17; S through Z, Thursday, May 18. Although Members and their families will be asked to present their invitation card for admission, the attendance arrangement, by alphabet, is an optional one.

As in the past, free round-trip charter bus service will be provided between the Loop and the Museum. These CTA busses, marked *FIELD MUSEUM*, will originate at the southwest corner of State and Jackson, with stops at the southwest corner of Michigan and Balbo. Two busses will be making continuous circuits, beginning at 5:45 and passing at about 15-minute intervals, until the Museum closes.

Plenty of free parking is available in Soldier Field lots and the Planetarium parking area, with a shuttle bus continuously circling the areas and collecting and discharging passengers at the Museum's south steps.

From 6 p.m. to 8 p.m. the Museum's food service area will provide complete dinners or snacks.

All Field Museum Members and their families are urged to come, and to reacquaint themselves with *their* Museum.



## *MEMBERS' NIGHTS* Scenes from Previous Years

# BOLIVIAN ADVENTURE

## *In Search of the Bones of Giants*

**By Larry G. Marshall**

*". . . The newly reported war does not disturb us. We are out of range of the guns. Bolivia was under martial law when we arrived, but the revolution fell flat. These people are not warlike . . . ."*—Elmer S. Riggs, Field Museum's curator of paleontology, seems a little too earnest as he tries to convince Museum director D. C. Davies in a letter dated September 13, 1924, that there is nothing to be alarmed about. Riggs was about to set out on phase II of the Marshall Field Paleontological Expedition to South America.*

In the autumn of 1922 Riggs had embarked on the most ambitious paleontological expedition ever attempted by Field Museum. His objective: to make, over the next five years, extensive collections of fossil mammals from Argentina and Bolivia. The expedition began its field work in Patagonia, southern Argentina, in January of 1923 and remained there until May of the following year.

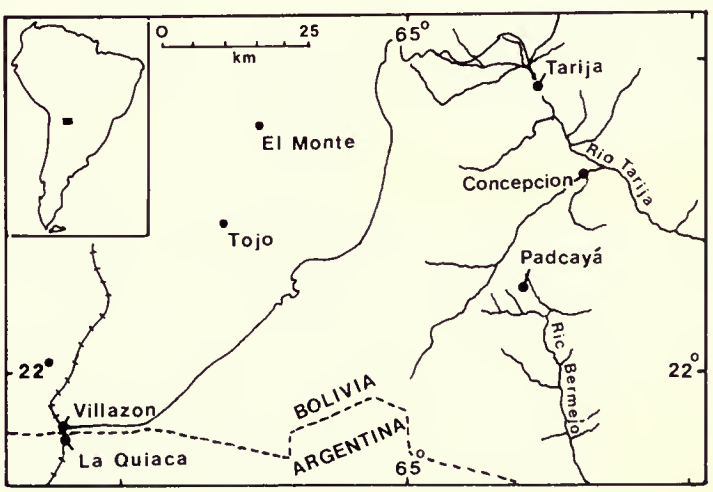
After completing his work in Patagonia, Riggs went to Buenos Aires, and from there wrote to the American consulate in La Paz, Bolivia, requesting permission to make collections of Pleistocene mammals in the Valley of Tarija in southern Bolivia.

Permission was granted, and on July 23, 1924, Riggs and his son Harold left Buenos Aires for La Paz. They disembarked at La Quiaca, on the Argentine side of the border, and from there crossed over to Villazon, on the Bolivian side. From this point one could travel to Tarija, 100 miles northeastward, by mule or bus. The former, more scenic, mode, required five days; the latter could make the trip in eight hours. Riggs chose passage on the 12-passenger bus, knowing they would later be obliged to make plenty of use of mules as they pursued their work in the interior.

From Villazon the road wound over a bleak, treeless plateau, which soon gave way to deeply incised river gorges; here the road followed every turn and angle of the drab canyon walls. Further on, the bus labored up steep, zigzagging grades. At last they came to a crest that overlooked the distant expanse of the Valley of Tarija—some 20 miles long and 9 miles wide. Two hours later the travellers had descended 5,000 feet to the valley floor.

Night was falling and lights were aglimmer as the groaning bus turned out of the dry river bed onto boulder-paved streets of the town of Tarija. At their approach, a cry was raised of "La auto, la auto!" as scores of barefooted children ran to greet the biweekly link with the outside world. A crowd of hundreds immediately gathered to glimpse the new arrivals, to help unload baggage

*Larry G. Marshall, a vertebrate paleontologist who has also done extensive field work in South America, is a visiting curator in the Department of Geology.*




*For an account of the first phase of the expedition, see "Adventures in Patagonia," by Larry G. Marshall, in the March, 1978,* Bulletin.

*Riggs chose passage to Tarija, Bolivia, on a 12-passenger alpine bus.*

and express parcels, and in whatever way possible to have a hand in the reception.

Riggs spent the first two weeks at Tarija reconnoitering the valley. He then organized a field party, which included one José Strucco, a 35-year-old artist from Italy, who was to be of much help in the months to come.

THE FIRST EUROPEAN VISITORS TO TARIJA, centuries ago, had noted that certain *huesos de gigantes*—"giants' bones"—were the objects of special veneration and wonder by the villagers. These were the fossilized remains of animals of great size found in the floor and sides of the valley. Even then the curious objects were recognized as having once belonged to gigantic beings, and the natives looked upon them as talismans, often putting them in a special place of honor in their humble dwellings.

Early in the seventeenth century, reports of huge bones and of domelike shells—thought to be the skulls of great creatures—had already been carried to the outside world by Jesuits, and in the course of time, scientists in Europe identified these curiosities as the teeth and bones of animals long extinct. Some found their way into museums and were eventually studied, described, and named.

In 1903 Count Créqui-Montfort, of Paris, purchased a large number of fossil mammals from Tarija resident Luiz Echezu who, with his brothers, had spent their leisure hours for many years in collecting Tarija Valley fossils. Duplicate specimens obtained from Echezu by Créqui-Montfort were described by M. Boule and A. Thévenin in a 256-page monograph, *Mammifères fossiles de Tarija,* published in Paris in 1920. Riggs was familiar with this work and was well aware of the fact that the valley was a fossil-hunter's paradise. Now that same valley lay before him, and he was eager to acquire some "giants' bones" for Field Museum.

Why did these bones occur in this particular valley, and why were they so abundant? Geologists and paleontologists have long pondered these questions, and an explanation is now possible: Beginning about 65 or 70 million years ago, and up to the present, the western edge

*Part of the extensive fossil collection of Bolivian Luiz Echezu.*

*Moving camp in the Tarija valley*

*Reconstruction of ground sloth skeletons discovered by Riggs in Bolivia.*

of South America experienced bouts of geological activity that resulted in uplift and the formation of the Andes. Most of Bolivia was included in this uplift and, as a result; is now mostly a high plateau, or tableland, averaging 10,000 to 12,000 feet in elevation. Adorning the plateau are jagged mountain ranges and snow-covered peaks. To the south, the plateau falls rapidly away into the bush covered plains of the Gran Chaco of Paraguay, southeastern Bolivia, and north-central Argentina. The southern slope of the Bolivian plateau is broken into lesser mountain ranges, which enclose valleys of varying size.

The largest and best known of these is perhaps the Valley of Tarija, which lies midway down the southern slope of the Great Bolivian Plateau. It is drained by the Río Tarija, a tributary of the Río Pilcamoyo, flowing eastward across the fertile grazing lands of the Gran Chaco to the Río Paraná. Ancient streams draining into the Valley of Tarija carried with them large quantities of mud and sand, which were deposited on the relatively flat valley floor. Century after century, these deposits gradually accumulated to great thickness.

The summer rains provided an abundance of moisture which, together with heat of a tropical sun, promoted succulent vegetation. Large animals, in search of browsing and refuge from the torrid heat of the Chaco plains below, followed the natural waterways up into the mountains. Always moving toward higher and cooler elevations, they eventually came upon the Valley of Tarija.

*Robert C. Thorne, former U.S. artillery captain, was hired by Riggs for his experience in operating a field camp and handling pack animals; but Thorne also did his share of digging out fossils.*

When the low plains became dry and parched, and the water in the usual drinking places failed, the lush vegetation of this valley and the cool waters of the mountain streams served as prime attractions for these animals. And so, the Valley of Tarija became a sort of "summer resort" for large animals, just as it later did for Indians, the Spanish, and today's tourists.

Many of the animal visitors died while at their "resort," and their bodies sometimes became entombed in the sediments carried down by the incoming streams. Today, midsummer rains are not as frequent as in the past, and the volume of streams entering the valley is much reduced. The vegetation is also not as lush as when the "giants" roamed these valleys. Instead of more sediments accumulating in the valley, the rainwaters are now eroding the layers of clay and ledges of sand, forming gulches and ridges. Here are to be found the fossilized teeth, bones, and sometimes entire skeletons of "giants" of centuries past.

Perhaps the most commonly encountered fossils are those of great, armored glyptodonts—distant relatives of the modern armadillo. Protected by great dome-like shells up to seven feet long, they generally resembled huge turtles. The shells, up to an inch thick, were a mosaic of hundreds of hexagonal *scutes,* or plates, each several inches in diameter. The glyptodont's head was protected by a bony *casque,* or helmet, and the short, squat legs were sheathed in bony plates; the massive tail was encased in overlapping bony rings. Thus protected, the animal had little to fear from any predator of that time.

At the approach of an enemy, the glyptodont only had to squat—bringing the edges of its shell to the ground, retract its head like a turtle, and wait for the attacker to withdraw. In some species the tail was like a great war club, studded at the end with horny knobs or blunt spikes. A quick swing of the club could deal a vicious blow.

Their rootless, peglike grinding teeth show that glyptodonts were grazing vegetarians with feeding habits similar to those of a horse; they were, in fact, the dominant grazers of their time. They had no tusks or other front teeth adapted for seizing food, and most likely gathered vegetation with an outthrust tongue.

Fossils of five or six species of ground sloths, represented by a great many specimens, were found in the Valley of Tarija, suggesting that they had been among the most common of the ancient dwellers in these regions. Heavy and ponderous, the ground sloth generally resembled a gigantic bear, and some, such as *Megatherium,* were nearly the size of an elephant. The hind legs were short and stout, and the hind foot—turned over on its

*Riggs (in dark suit), Strucco (with pipe), and Thorne (rt.) pose with Bolivian field assistants.*

*Riggs at the work he loved best. Remarkably productive during his lifetime of 94 years (1869-1963), Riggs was a Field Museum curator for more than four decades.*▼

*The Bolivian venture was not an uninterrupted field trip. Riggs at right; the others are unidentified.*

side—was armed with three strong claws; a great heel protruded backward. The leg joined the foot midway between claws and heel. The fore-feet had great claws, suitable for seizing and pulling down edible leaves, twigs, or fruit. Since these animals were without front teeth, they must have seized their food with a long, prehensile tongue, somewhat in the manner of giraffes. The food was then ground up by a broad battery of teeth and strong, massive jaws. Although inoffensive, ground sloths were far from defenseless. Any attacker venturing too close risked being gashed by the formidable claws or being crushed in a bearlike hug.

The partial skeleton of a ground sloth known as *Scelidotherium* was found one day by Strucco. Its head was partly exposed by erosion, while the rest of the skeleton was buried. As Strucco and his party were busy excavating the specimen, the landowner appeared. Drunk and surly, he demanded compensation for the unauthorized excavation, but Strucco was stubborn. After a protracted dispute and the smoking of several cornhusk cigarettes, the two parties finally came to an amicable settlement: the landowner was to receive two pesos, or 65 cents, for the privilege of digging on his property. The excavation proceeded without further incident.

Another great extinct animal of this region was the toxodont. The name, meaning "bow-tooth," and referring to the strongly curved upper grinding teeth, was given by the British anatomist Sir Richard Owen upon studying specimens brought back to England by Charles Darwin nearly a century before. Toxodont was a ponderous beast, with forelimbs shorter than the hind. The dorsal placement of the eyes, ears, and nostrils suggests that it had aquatic habits. The animal's general appearance was that of a hippopotamus; it apparently lived near rivers and streams and was a plant-eater.

Glyptodonts, ground sloths, and toxodonts were all members of groups which originated in South America, but discovered in the same fossil beds as these animals are others which originated on continents to the north, and which have close living relatives in North America, Europe, and Asia. These "immigrants" came to South America from North Ameria via the Panamanian land bridge, which was formed only a few million years ago. Before the appearance of this bridge there was no continuous connection between the two Americas, and South America was, as Australia is today, an "island

*Glyptodont, on view in Hall 38*

continent." Some of the animal immigrants from the north have names familiar to most of us, including the deer, horses, dogs, cats, and skunks, and relatives of the camel and of the elephant.

Elmer Riggs looked for fossils in the Valley of Tarija between July and November, 1924, when the approach of the torrential midsummer rains made further collecting impractical. The specimens were packed in large wooden crates and taken by truck to La Quiaca. From there they went by train to Buenos Aires, and then by ship to Chicago. Riggs and his son left Tarija in December.

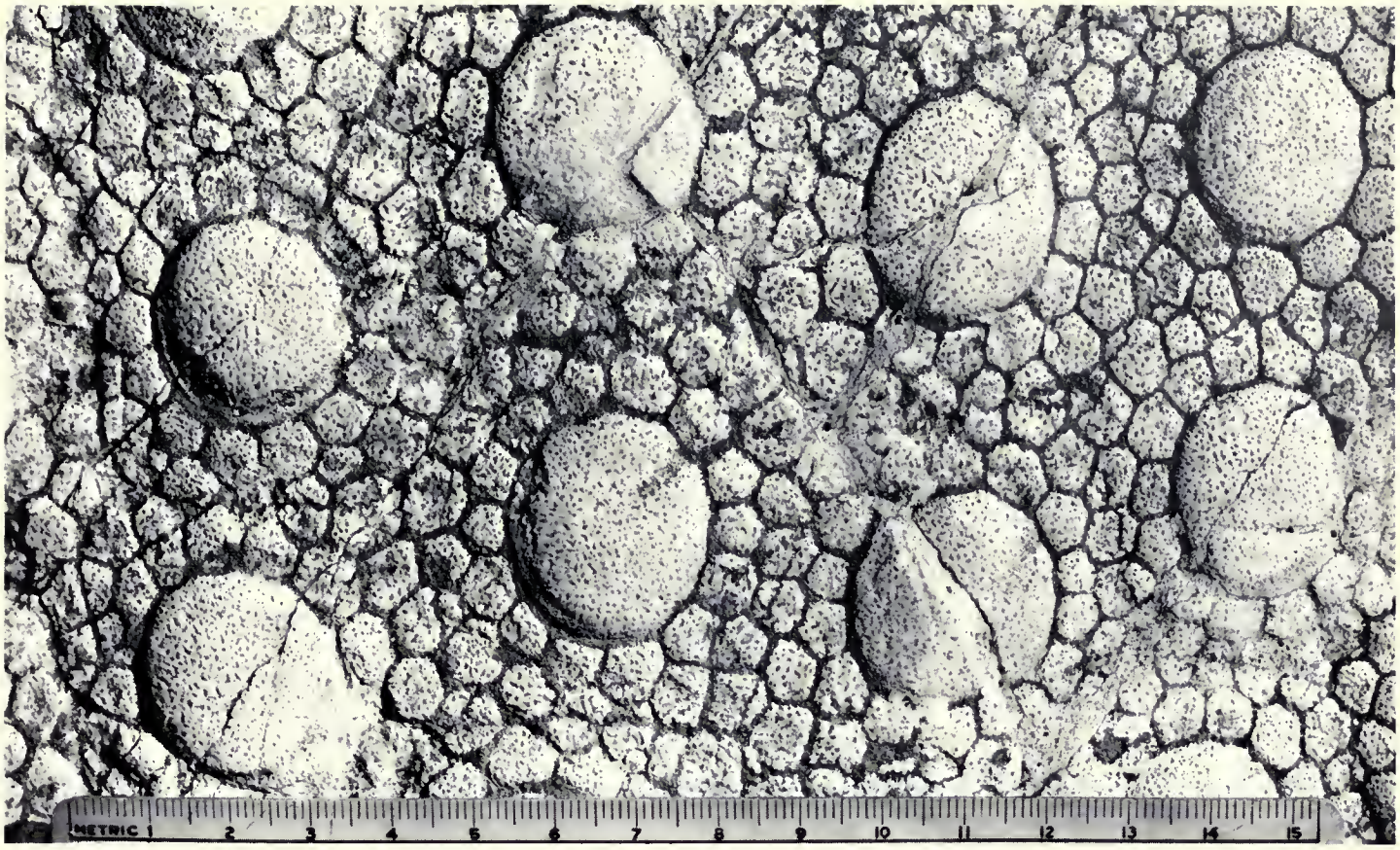
Some two and a half years later, Riggs, accompanied now by Robert C. Thorne of Vernal, Utah, returned to Tarija to resume his unfinished work; and once again he was joined by José Strucco. The main qualification of Thorne, a former captain in the U.S. artillery, was his experience in operating field camps and in working with pack animals.

Upon his arrival at Tarija, Riggs found another revolution in progress and the province again under martial law. Because of this, the local constable would not grant permission to resume diggings. As a special favor, Riggs was allowed to establish camp at one of the sites he had worked in 1924, but the constable gave explicit instructions that actual digging could not be done, and the next morning a cavalry contingent rode out to make sure that the orders had not been violated. In just a matter of days, however, the constable did come through with permission for collecting to resume—but just in the vicinity of Tarija.

While awaiting permission to work other areas, Thorne and Strucco reconnoitered the Valley of Padcayá, some 30 miles south of Tarija. The Padcayá valley was only about one-fourth the size of the Tarija, but Thorne and Strucco reported back that it was rich in fossils and apparently had never been worked by collectors. Within two days, camp was established at Padcayá, well beyond the constable's jurisdiction and well south of the mini-revolution.

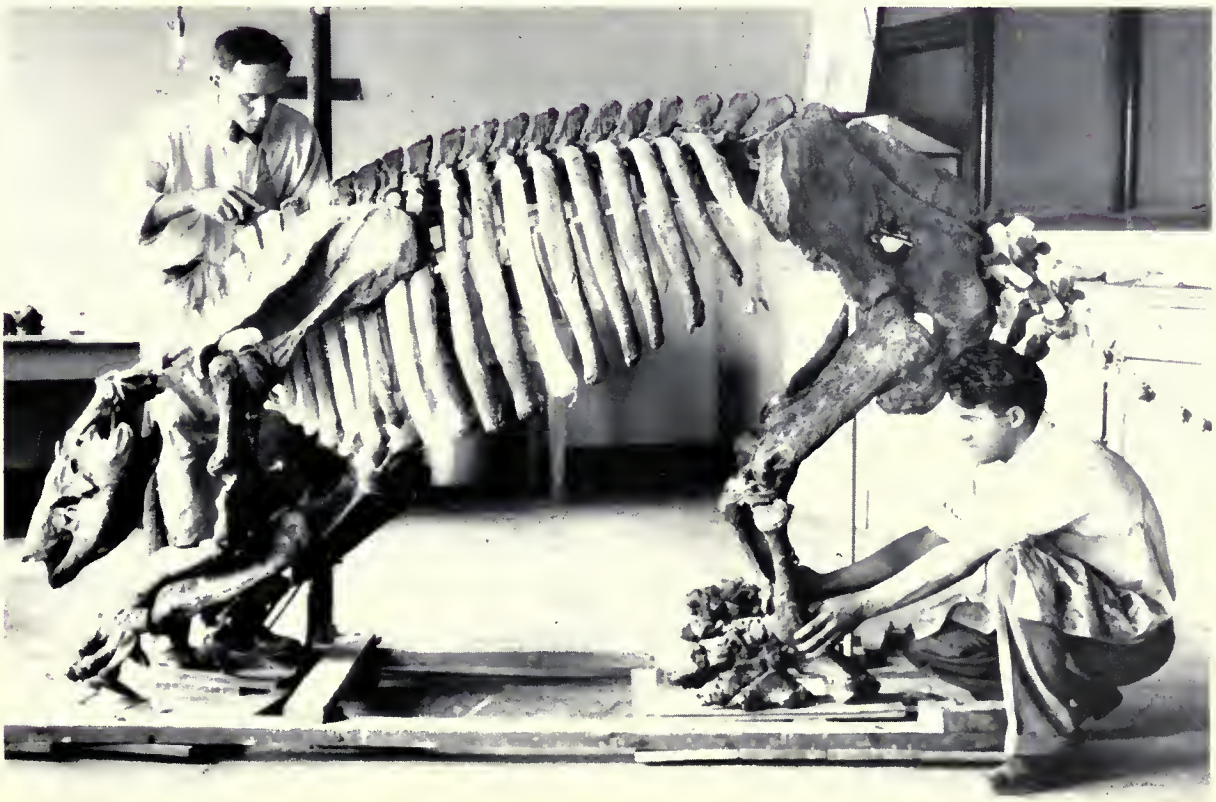
The beds near Padcayá were similar in age and origin to those of Tarija, and many of the fossil mammals proved to belong to the same species. The valley had once been occupied by a lake, the shoreline of which could still be distinguished. The latter part of June and all of July were spent in the little valley, during which several prize specimens were secured. Early in September permission was finally received to collect again in the valley of Tarija, and camp was set up there.

By the end of September collecting activities for the second Marshall Field Paleontological Expedition came to an end. It had been a long, drawn-out enterprise, not without its hazards; but Riggs returned to Chicago with a special sense of achievement. During his five years' work on the continent, he had amassed for Field Museum more than 1,200 specimens of fossil animals from Argentina and Bolivia—the largest collection of South American fossils outside South America. □




*Detail of glyptodont shell*

*Museum preparators complete restoration of ground sloth* (Scelidotherium) *skeleton in early 1930s. James H. Quinn (rt.), who died in September, 1977, was a Field Museum preparator for 17 years. Subsequently he entered college, obtained a doctorate, and became a professor of paleontology at the University of Arkansas. The other preparator is unidentified.*



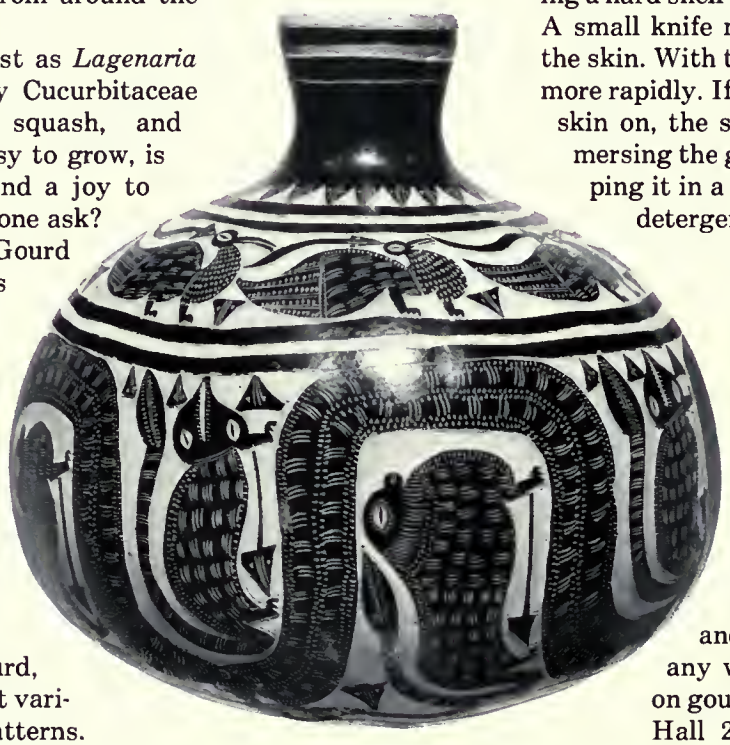
# The Versatile Gourd

by Alfreida Rehling

What product of your backyard garden can be made into bottles, drinking vessels, other kitchen utensils, rattles, toys, or decorative conversation pieces for the wall or mantel? Well, the common gourd, of course. Gourds have been used for these and other purposes by peoples of many cultures from around the world for centuries.

Known to the botanist as *Lagenaria siceraria*, within the family Cucurbitaceae (which includes pumpkins, squash, and cucumbers) the gourd is easy to grow, is attractive in the garden, and a joy to decorate. What more could one ask? Members of the American Gourd Society include the plant's most ardent admirers.

On warm summer evenings the gourd's night-blooming flowers are a lovely spectacle: large, white, almost luminous blossoms set amidst huge, soft, velvety leaves. The plants are vigorous, quickly spreading over a large area. The fruit, or gourd, that follows occurs in a great variety of shapes, sizes, and patterns. The "Hercules' club" gourd grows to three feet in length, the "snake" gourd to six; the Chinese gourd is mature when it reaches two inches. There are so-called "box-shaped" and "basket-shaped" gourds, and from Guatemala, "water jugs." The gourd may be modified into various shapes by tying rope, tape, or similar material around the developing fruit. The Chinese grow them in molds.

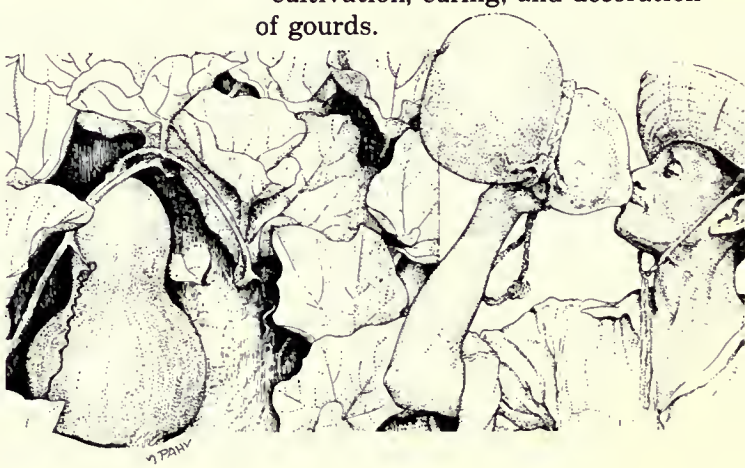


*Carved gourd of Yoruba tribe, Nigeria.*

A properly cured gourd will last almost indefinitely. A reliable indication of whether a gourd is mature, and thus ready for curing, is the fingernail test: If the skin, or rind, can be scraped from the gourd, revealing a hard shell beneath, the gourd is mature. A small knife may be used to scrape away the skin. With this removed, the gourd dries more rapidly. If the gourd has dried with the skin on, the skin may be softened by immersing the gourd in warm water or wrapping it in a towel soaked in a solution of detergent or ammonia.

The gourd is now ready for whatever kind of design one's fancy dictates. It may be dyed, stained, painted with various media, carved, burned, or simply scrubbed and waxed to preserve the natural beautiful patina.

On Members' Nights, May 15, 16, 17, and 18, the Department of Botany will feature a special exhibit on gourds, "Out of Your Gourd," in Hall 28. Botany staff will be on hand to answer questions on the cultivation, curing, and decoration of gourds.



*Alfreida Rehling, a member of the American Gourd Society, is herbarium assistant, Department of Botany.*

(CONTINUED FROM P. 12)

Experimentation with guayule production is being undertaken by the Mexican government in Saltillo, just south of Texas, where 2.6 million tons of the plant grow wild. At its pilot plant, more than one ton of plant material per day can be converted into a yearly output of more than 30,000 tons of rubber. Guayule can be cultivated in California, New Mexico, Arizona, and Texas and estimates suggest that more than five million acres of land could support the plant. The NAS suggested that the U.S. use some of this land for guayule experimentation and cooperate with Mexico to determine the market and economic feasibility for such production. The NAS panel also pointed out the need to develop strains of guayule yielding higher quantities of rubber. Senator Pete Domenici (N.M.) and Rep. George Brown (Calif.) have introduced legislation (S. 1816 & H.R. 3476) to authorize $60 million for research on guayule. Both bills are pending with hearings to be held later this year.

Henry Yokoyama, of the U.S. Department of Agriculture, reported that guayule rubber production could be increased by as much as two to six times the normal yield by spraying the plant with a mixture of low-cost chemicals. Under optimum conditions, a guayule plant usually contains about 20 percent rubber. After applying the chemicals, Yokoyama found the yield could be increased by 35 to 40 percent and could cut the growing time by as much as two years. The chemicals are all naturally-occurring components of the plant, and Yokoyama is confident that they will be found safe.

*Hevea* rubber production is already strained, and political situations, coupled with increasing natural rubber demands, point to further difficulties. The guayule shrub, which can be grown and processed in the United States, might relieve some of the tension. Such a rubber production program would have many benefits. It would create a new industry employing many people, it would decrease our dependency on imported natural rubber and help alleviate our balance of payment deficits, and might provide a cash crops for Southwest Indians. Furthermore, it might be possible to use less synthetic rubber, a product which consumes precious petroleum and creates more pollution during processing than does natural rubber. Thus, a small plant may play a large role in the rubber industry's future.—*Mark Henze, National Wildlife Federation*

### Old Forest Vital to Certain Wildlife

Research reported by the Illinois Natural History Survey reinforces the fact that some wildlife depends on old-growth forests during all or part of the year. The survey noted that red-headed woodpeckers in Illinois occupy primarily forest-edge, savannah habitats in summer and mature bottomland oak forests in winter. Besides the habitat shift, the survey reported, there also is a geographic shift southward which brings large numbers of red-heads to southern Illinois in alternate winters. Those large populations concentrate in mature bottomland forests which produce quantities of acorns on which the birds feed.

That habitat preference puts them at odds with foresters, whose long-standing policy has been to cut old forest stands. Such stands are being decimated by farmers and reservoir builders also, the survey said.

## FIELD MUSEUM OF NATURAL HISTORY MEMORIAL FUND

*From time to time, Members and friends of Field Museum send contributions to the Museum in memory of someone who has just passed away, or on the anniversary of that person's death.*

*Whenever you wish to honor a deceased friend or loved one, or remember the anniversary of that person's death, you may do so by sending a Memorial Gift (in any amount) to Field Museum. The family of the person you so honor will be notified by letter (without mention of the amount given), and your name and the name of the deceased will be listed in the Museum's next biennial report.*

*The form below may be used the next time you wish to send such a memorial in lieu of flowers. You may designate whether you would like your gift used for program or endowment.*

**Field Museum of Natural History Memorial Fund**

$_____

Given by_____
donor's name

_____
street city state zip

To be applied to (check one): Program_____ Endowment_____

In memory of_____
name of deceased

Send notification to_____

_____
street city state zip

*Mail this form (or facsimile) to Development Office, Field Museum, Roosevelt Rd. at Lake Shore Dr., Chicago, Ill. 60605*

(*from page 3*)

# FIELD BRIEFS

### Anthropology Internship Program Applications Now Available

"Is it worth it?" This question headlines the new 1978 poster recently sent out by the Center for Advanced Studies at Field Museum to announce the second year of its innovative Internships Program in Anthropology, sponsored once again by the National Endowment for the Arts, a federal agency.

Is *what* worth it? The Internship Program in Anthropology is a pilot educational program designed to give advanced undergraduates and early graduate students the chance to find out if a career in anthropology is worth the hard work and long years of study needed to obtain an advanced degree. The chance offered them is to be a professional "junior colleague" in Field Museum's Department of Anthropology for six months, full-time, with a stipend of $300.00 a month and a travel allowance of $240.00.

If the experiences of the five interns selected last year are any indication, the answer from the five new interns to be selected this year will also be: "Yes, definitely." As Kris Jones, one of the 1977 interns, wrote: "Not many people get the chance at the beginning of their career to ask: 'Is it worth it?' Even fewer people can say: 'I had the chance and it is worth it.'"

Interns are responsible for designing and implementing research or curatorial projects. Research projects may relate to any area within anthropology, *e.g.*, human geography, ethnology, biological anthropology, or archaeology. Curatorial projects may relate to any facet of museum work and administration, *e.g.*, exhibit planning, conservation, collection management, computer data banking, and exhibits research.

Three examples of internship projects completed by 1977 interns are as follows:

- *Field Museum's Southwestern basketry collection,* one of the biggest and oldest collections in the world: Kris Jones studied culture change in basketry production, in particular, change fostered by the tourist market. She presented a paper on her internship research at the 25th annual meeting of the American Society of Ethnohistory last year.
- Jane Swanson researched exhibits psychology and visitor effectiveness.
- Jeff Clark, working with associate curator John Terrell, prepared a critical review of Oceanic archaeology for the 1978 *Annual Review of Anthropology.*

The deadlines for the receipt of applications this year are April 3 and July 3. Application forms may be obtained by writing: Anthropology, Center for Advanced Studies, Field Museum of Natural History, Roosevelt Road at Lake Shore Drive, Chicago, Illinois, 60605.

### CORRECTION

The photo which appeared on page 26 of the April 1978 *Bulletin* was incorrectly credited. The photographer was Andy Cawthon.

# BOOKS

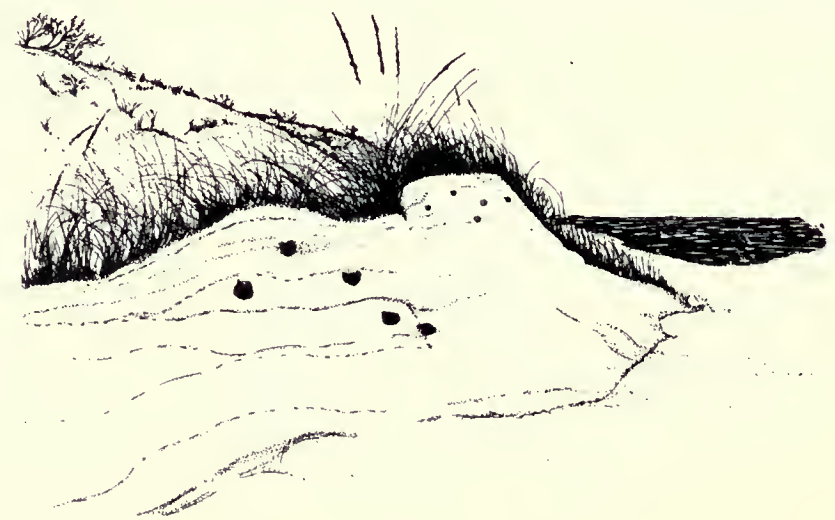
**DUNE COUNTRY, by Glenda Daniel (Swallow Press, 167 pp.; paper, $4.95).**

If you're thinking about making your first visit to the Indiana Dunes or wondering whether it's time to go again, you'll find *Dune Country* the perfect companion for the trip. Small enough to fit right into your lunch sack, this little paperback touches on almost everything you might wonder about as you walk the trails: How did the dunes come to be? Why do bearberries and cactus grow here as neighbors? How much water can sphagnum moss absorb? When are yellow puccoon or lavender blazing star in prime bloom? The abundant, delightful, black and white illustrations by Carol Lerner provide instant identification of typical dune inhabitants, and a listing of plants by the habitat they prefer helps the curious hiker search out the ones in season.

The Field Museum spring and summer field trip schedule includes the Indiana Dunes and the Illinois Dunes State Park—*Dune Country* is good background for both.—*Betty Deis, Department of Education.*

---

*Dune Country* is available at the Museum Shop; 10% discount for members.



*Illustrations by Carol Lerner, from* Dune Country

# *May and June at Field Museum*

*(May 15 through June 15)*

### Last Chance to See and Do

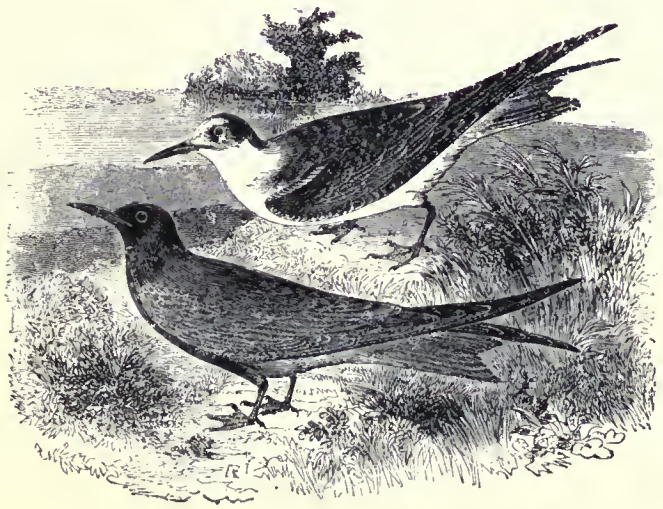
**Peru's Golden Treasures**—closes May 21. A dazzling collection of 225 pre-Columbian gold artifacts, on loan from the Museo Oro del Peru, Lima, comprises the largest collection of its kind ever shown in the United States. Augmenting the Museo Oro del Peru pieces, which survived the Spanish conquest of Peru in 1532, are more than 50 antiquities from Field Museum's own collections and from those of the Peabody Museum at Harvard. Hall 26.

**Discovering the Moche**—Fridays and Sundays, through May 21, at 11 a.m. and 2 p.m. Short documentary film interprets the symbolism in pottery designs made by Peruvians 1,000 years before the Incas. Shown in conjunction with the *Peru's Golden Treasures* exhibit. Simpson Theatre, ground floor west.

**Potato Planters**—Fridays and Sundays, through May 21, at 11 a.m. and 2 p.m. Short documentary film surveys the modern Peruvian Aymara Indians who continue to live like their pre-Columbian ancestors. Shown in conjunction with the *Peru's Golden Treasures* exhibit. Simpson Theatre, ground floor west.

**Lord of the Labyrinth**—Saturdays, through May 20, at 11 a.m. Newly released BBC-TV production features new developments in recent archaeological fieldwork by Field Museum anthropologists on the north coast of Peru. Shown in conjunction with the *Peru's Golden Treasures* exhibit. Simpson Theatre, ground floor west.

**Spring Journey for Children: Exploring the Ancient Andes**—through May 31. Free self-guided *Journey* leads children and families through museum exhibits to learn about the lifestyles of ancient Andean cultures. *Journey* pamphlets are available at the information booth, main floor.



### New Programs

**Members' Nights—May 15, 16, 17, 18.** Field Museum's famous behind-the-scenes open house is to be held this year on four consecutive evenings. From 6 p.m. to 10 p.m., the museum offers a myriad of activities—special displays, lectures, games, tours, and demonstrations—especially for you. We hope to see you then.

**Tahuantinsuyo, Music of the Andes**—May 20 and 21, at 2 p.m. *Tahuantinsuyo*, the name the Incas gave to their empire, is also the name of a group of three talented musicians who are dedicated to researching and performing authentic music from the Andes. The program includes pre-Hispanic songs and instrumentals from the highlands of Peru, Ecuador, Bolivia, and northern Argentina. Members $2.50; nonmembers $4.50.

**Chinese Puppet Plays and Lecture Demonstrations**—June 3, at 1 p.m., 2 p.m., and 3 p.m. In conjunction with the *Folk Art in China* exhibit, the Yueh Lung Shadow Theatre will present three performances of the traditional 2,000-year-old shadow puppet plays. This ancient Chinese folk art was brought to the United States in the 1850s by Chinese immigrants. It eventually disappeared from this country and was in danger of disappearing even in China. Not until recently was this ancient art form revived. Write the department of education for reservation form.

### New Exhibits

**Folk Art in China**—through July 5. A special exhibit of approximately 150 utilitarian and symbolic objects dating from the mid-15th to the 20th century. Each artifact expresses the underlying characteristic of its period. Included in the exhibit are: bamboo furniture, woodblock prints, textiles, tile engravings, folk paintings, baskets, paper crafts, statues, metalwork, and lacquered leathers. Hall 27.

*Calendar continued on back cover*

# *May and June at Field Museum*

*(CALENDAR continued from inside back cover)*

**Locks from Iran: A Key to a Culture**—through July 30. A unique exhibit of 463 locks from Iran, surveying 16 centuries of lockmaking, comes to the United States from the people of Iran under the patronage of the queen of Iran. Most of the padlocks are handmade; many resemble human and animal figures; all demonstrate the significance of locks to the Iranian people as means of security, cultural symbols, and artistic expressions. The exhibit is being circulated by the Smithsonian Institution Traveling Exhibition Service (SITES). Between Halls J and L.

### Continuing Exhibits

**Field Museum Gameian.** Field Museum's 19th-century Javanese gamelan, an ensemble of 24 fine bronze and wood musical instruments, has been completely restored for exhibition. It is the oldest and perhaps finest gamelan outside Indonesia. Hall K, ground floor.

**Pawnee Earth Lodge.** This exhibit, in Hall 5, is a traditionally made Pawnee earth lodge—the home and ceremonial center of Pawnee Indians as it existed in the mid-1800s. Daily programs provide the opportunity to learn about Pawnee culture. Public program hours: Monday through Friday, 1:15 p.m.; weekends, 11 a.m. and 1:15 p.m. Tickets may be obtained 15 minutes prior to the program at the north information booth. Programs limited to 30 people.

**The Piace for Wonder.** This gallery provides a place to handle, sort, and compare artifacts and specimens. Weekdays, 1 p.m. to 3 p.m.; weekends, 10 a.m. to noon and 1 p.m. to 3 p.m. Ground floor, near elevator.

### Continuing Programs

**On Your Own at Field Museum.** Self-guided tour booklets, adult- and family-oriented, are available for 25¢ each at the entrance to the Museum Shop, main floor north.

**Weekend Discovery Programs.** Guided tours, demonstrations, and participatory activities. Every Saturday and Sunday, 10 a.m. to 3 p.m.

**The Ancient Art of Weaving.** Demonstrations every Monday, Wednesday, and Friday, 10 a.m. to noon. South Lounge, 2nd floor.

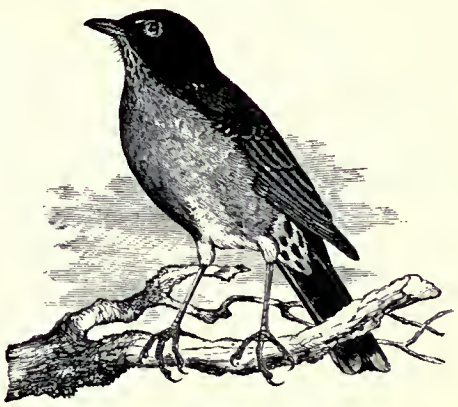
**Audio Information System.** The museum's newly installed audio system, *Uniguide*, enables visitors of all ages to visit selected exhibits in any sequence. Audio receivers and maps available for $1.25 per person, $3.75 for a family of up to five at the entrance to the Museum Shop, main floor north.

### May and June Hours

**The Museum Opens** daily at 9 a.m. and closes at 6 p.m. every day except Friday. On Fridays the Museum is open to 9 p.m.

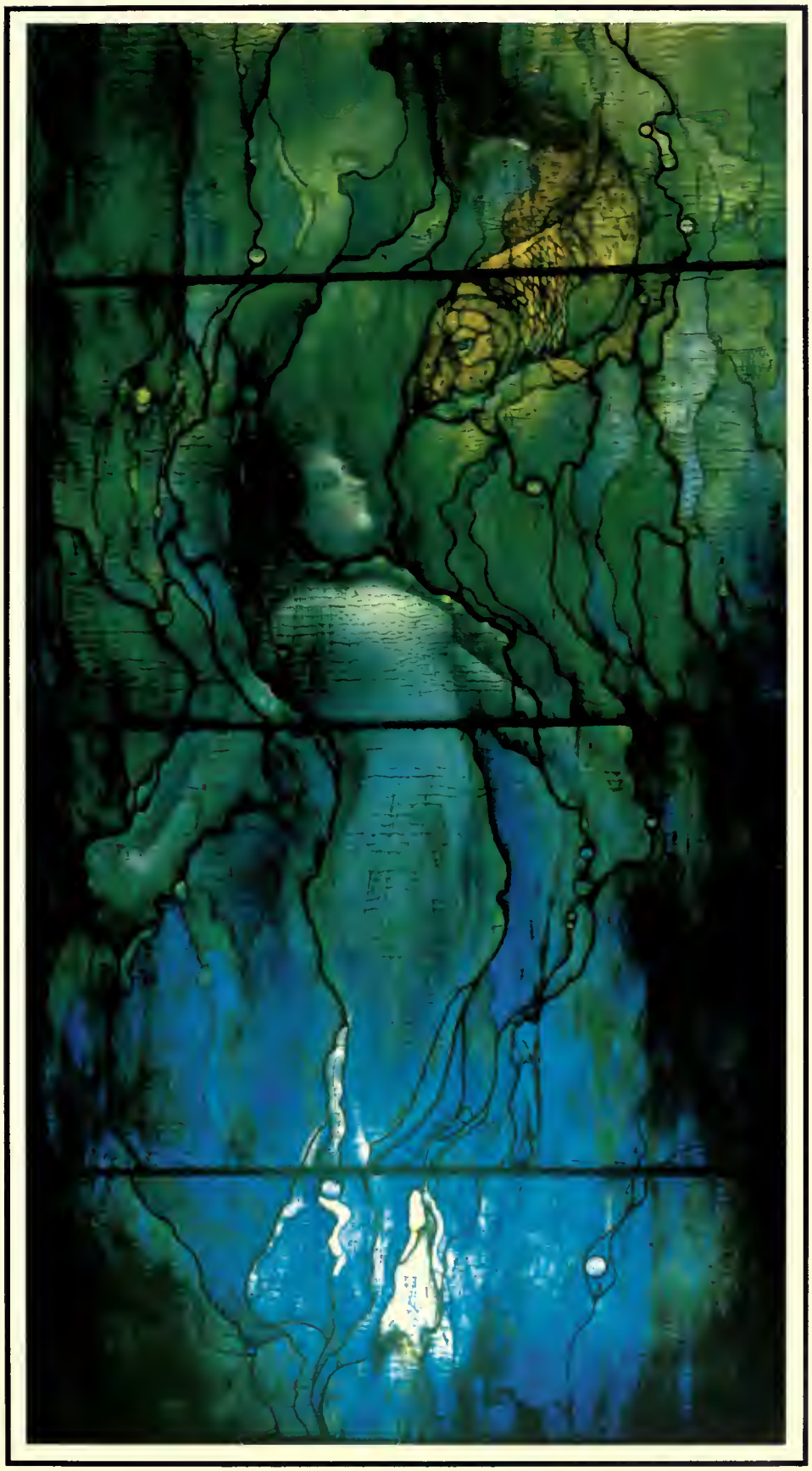
**The Museum Library** is open weekdays 9 a.m. to 4 p.m. Obtain a pass at reception desk, main floor.

**Museum telephone:** (312) 922-9410



June
1978

Field Museum of Natural History Bulletin



**Field Museum of Natural History Bulletin**

June 1978
Vol. 49, No. 6

*Editor/Designer:* **David M. Walsten**
*Production:* **Oscar Anderson**
*Calendar:* **Nika Semkoff Levi-Setti**
*Staff photographer:* **Ron Testa**

**Field Museum of Natural History**
Founded 1893

*President and Director:* **E. Leland Webber**

BOARD OF TRUSTEES

William G. Swartchild, Jr., *chairman*
Mrs. T. Stanton Armour
George R. Baker
Robert O. Bass
Gordon Bent
Harry O. Bercher
Bowen Blair
Stanton R. Cook
O. C. Davis
William R. Dickinson, Jr.
Thomas E. Donnelley II
Marshall Field
Nicholas Galitzine
Paul W. Goodrich
Hugo J. Melvoin
William H. Mitchell
Charles F. Murphy, Jr.
James J. O'Connor
James H. Ransom
Mrs. Edward F. Swift
John S. Runnells
William L. Searle
Edward Byron Smith
Robert H. Strotz
John W. Sullivan
Edward R. Telling
Mrs. Theodore D. Tieken
E. Leland Webber
Julian B. Wilkins
Blaine J. Yarrington

LIFE TRUSTEES

William McCormick Blair
Joseph N. Field
Clifford C. Gregg
Samuel Insull, Jr.
William V. Kahler
Remick McDowell
James L. Palmer
John T. Pirie, Jr.
Donald Richards
John M. Simpson
J. Howard Wood

CONTENTS

3 **Field Briefs**

6 **The Archaeologist as Witch**
*By Thomas J. Riley*

12 **Our Environment**

16 **Buddhism and Taoism in Chinese Sculpture:**
A Curious Evolution in Religious Motif
*By Art Pontynen*

22 **Yang Jen, the Man Whose Hands Could See**
A remarkable Chinese mask in the Field Museum collection

23 **June and July at Field Museum**
Calendar of coming events

COVER

Stained glass window depicting a mermaid rising in the sea, designed by Louis Tiffany. On permanent view in the H. N. Higinbotham Hall ("the Gem Room"), shown below. This superb window, 44 x 80 inches, was the gift in 1972 of Frank G. James, of Palo Alto, Calif. It had been on loan to the Museum from Mr. James since 1939. Photo by Ron Testa.

*H. N. Higinbotham Hall, showing Tiffany window*

*Field Museum of Natural History Bulletin* is published monthly, except combined July/August issue, by Field Museum of Natural History, Roosevelt Road at Lake Shore Drive, Chicago, Il. 60605. Subscriptions: $6 a year; $3 a year for schools. Museum membership includes *Bulletin* subscription. Opiniona expressed by authors are their own and do not necessarily reflect the policy of Field Museum. Unsolicited manuscripts are welcome.

*Field Museum volunteers Hermann C. Bowersox and William E. McCarthy assisted in the editorial preparation of this issue.*

# FIELD BRIEFS

### Field Museum Hosts Systematics Symposium

On April 14 and 15 Field Museum hosted the first Field Museum "Spring Systematics Symposium." Attended by some 145 research scientists and graduate students, the symposium was entitled "Systematics and Ecology: Adaptive Morphology and Life-History Strategies." The local committee for the symposium included Robert Faden (chairman), William C. Burger, Robert F. Inger, Robert K. Johnson, John B. Kethley, and Loren I. Nevling, Jr.

The six speakers addressed a wide variety of topics: Robert K. Colwell, University of California, Berkeley (flower-dwelling mites and the hummingbirds which transport them from blossom to blossom); James A. Hopson, University of Chicago (brain size in dinosaurs and the question of whether or not dinosaurs were warm-blooded); James C. Hickman, University of California, Berkeley (life-history types in plants); Thomas L. Poulson, University of Illinois at Chicago Circle (life histories of and interactions among cave-dwelling animals); John B. Kethley, associate curator of insects, Field Museum (relationships among parasitic mites and among their hosts); Stephen Jay Gould, Museum of Comparative Zoology, Harvard University (relationships between morphology and life-history in animals). The symposium was partially supported by a grant from the National Science Foundation.

### Staff Notes

David E. Willard and John W. Fitzpatrick have recently joined the Division of Birds. Willard is the new custodian of the bird collection and will supervise moving the entire 300,000-specimen collection to the new storage area on the third floor. He is a native of Madison, Wisconsin, received his B.A. from Carleton College, Northfield, Minnesota; and his Ph.D. from Princeton University. Fitzpatrick is the new assistant curator of birds and head of the Division of Birds. A native of St. Paul, Fitzpatrick received his B.A. from Harvard University and his Ph.D. from Princeton University.

Mary A. Cassai has been named public relations manager. Since 1970 Mrs. Cassai has been public relations associate for the New York Public Library. Earlier, she taught English at the elementary and high school levels and served on the faculty of Brentwood College, Brentwood, N.Y., where she was dean of students. Mrs. Cassai received her B.S. and M.A. degrees from St. John's University, Jamaica, New York, and her Ph.D. (in English and American literature) from New York University.

Tibor Perenyi, Field Museum staff member since 1962, retired in April. A senior staff illustrator for the Department of Exhibition at the time of his retirement, Perenyi had earlier worked as an artist for the Department of Geology. During his museum career he did illustrations for more than 60 technical works by members of the Museum's scientific staff. Among his numerous other projects were painting the bodies of cave men in the cave man dioramas and designing the 1963 space geology exhibit. A native of Hungary, where he earned a law degree and later worked as a sculptor, Perenyi has returned to Europe. After 22 years in the United States, he and his wife, Lilla, are now making their home in Vienna, Austria.

### FMNH Joins OCLC

On March 15 the Field Museum Library entered the computer age. We officially began to catalog our books using OCLC, an on-line union catalog and shared cataloging system. OCLC (not an acronym) was founded in 1967 as the Ohio College Library Center and its shared cataloging system has been operational since 1971. At present about 700 libraries throughout the country (with some 2,000 terminals) are members of the system. In a recent week more than 253,000 books were cataloged by member libraries and more than 1,800,000 cards produced. In excess of 3,600,000 catalog records are now in the system.

At present we are using the system for the searching and cataloging of books. Let's suppose that a museum curator requires a book we don't own. The librarian sits at the terminal, a TV-like screen with attached keyboard. He enters his secret number and calls the data base at Columbus, Ohio. It says "Hello." The librarian then requests the computer to search for the book (this can be done in many ways: by author, by title, or by a combination of both). If the book is in the system the record appears on the screen and remains for as long as you need it. The record includes a list of all the libraries in the system that have cataloged the book, together with all the information that would normally appear on a library catalog card. The librarian can use this information to either borrow the book by interlibrary loan or to order it for our collection.

Let's suppose further that we have ordered the book and are now ready to catalog it. The cataloger recalls the record and makes the necessary changes to the record: different call number, subject headings, etc. These changes are necessary to make the record conform to our usage but do not affect the record in the data base. When all changes and corrections have been made, the cataloger commands the computer to produce cards. These are received about one week later, completely typed, alphabetized, and ready to be filed. In the event that the book is not listed in the system the library is required to input cataloging. This is done on-line according to OCLC cataloging guidelines. Once this is done other libraries in the system can use our cataloging, now on-line, and will also know that we have the book.

Early tests indicate that 75 percent of incoming books have already been cataloged in the system. This speeds up the cataloging process tremendously for us and gets the books to the shelves much faster than previously. The whole laborious, time-consuming process of typing and proofreading of cards has largely been eliminated. This means that the cataloging staff can do much more cataloging in the same amount of time. And it's fun to use!—*William Fawcett, Field Museum Librarian.*

*Chinese ceramic horses, T'ang dynasty, gifts of the Helen L. Kellogg Trust.* Ron Testa

### C. John Albrecht

C. John Albrecht, Field Museum taxidermist from 1926 to 1945, died in Clitherall, Minnesota, recently at the age of 86. Albrecht's most ambitious project while at Field Museum was the "African Water Hole," in Hall 22. At the time of its completion (and perhaps even now), this exhibit was the largest grouping of mounted animals in existence. Albrecht was also accomplished as sculptor, photographer, and lecturer, and he participated in 32 collecting expeditions around the world. Among his sculptures is the bust of Bushman, the gorilla (shown in the September, 1977, *Bulletin*), now on display at the Adventurer's Club in Chicago.

*C. John Albrecht (1891-1978)*

Albrecht is survived by his wife, Carma, and a daughter, Mrs. William (Carma Jane) Stroupe.

### Newly Acquired Chinese Sculpture: Two T'ang Horses From the Helen L. Kellogg Trust

Along with its collection of early Chinese statuary in stone (See page 16), Field Museum also possesses significant holdings of ceramic sculpture: about 250 pieces, mostly from the Han (260 B.C.-A.D. 221) and T'ang (A.D. 618-907) dynasties.

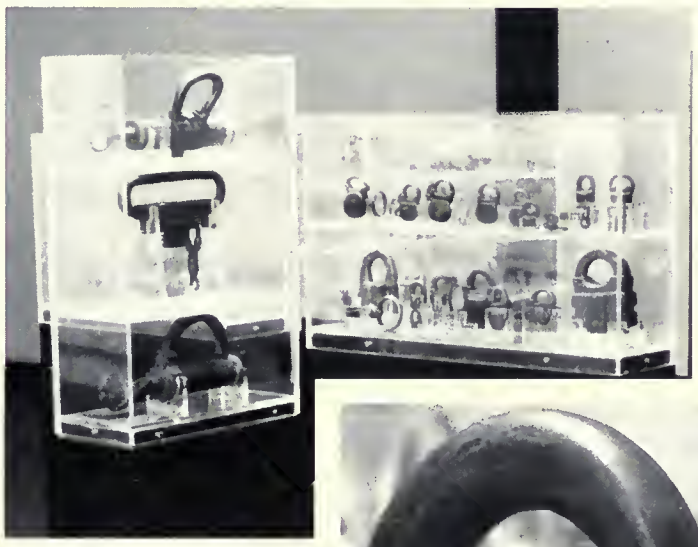
Most were acquired early in this century, before the large-scale counterfeiting of T'ang figurines began. A greater number of them are thus more apt to be genuine than similar, but more recently acquired pieces at other institutions. (T'ang statuary is notorious among archaeologists as perhaps more often faked than any other type of ancient art.) However, despite the genuineness of the Field Museum figurines, they were acquired over a short period and on a small budget. This means that most are of only moderate artistic importance (with major exceptions, such as the trio of ladies in court costume displayed in Hall 24) and that they do not cover the full range of

materials and forms known to have been used during Han and T'ang.

The Museum is therefore enthusiastic when its collections can be expanded through the generosity of donors. The two horses shown here are a case in point. Recent gifts of the Helen L. Kellogg Trust, in memory of John L. Kellogg, they represent an important T'ang style of which the Museum formerly had no examples.

Both horses are richly caparisoned and posed in the dynamic stance characteristic of the mature T'ang tradition, with tensed muscles, flaring nostrils, and sharply arched necks. The one on the right has traces of glassy material on its surface, showing that it was once covered with a thin glaze, now almost entirely flaked away. The other (probably the finer of the two) was not glazed but painted; its saddle retains most of its original ornament, finely traced floral designs in vermilion red.

Present plans are to place both horses on exhibition within the next few months. They will join several other fine pieces of T'ang sculpture, currently in the reserve collections, in a new case in Hall 24. — *Bennet Bronson, associate curator of Asian archaeology and ethnology.*



*Iranian locks on view to July 30.*

William E. McCart

### New Women's Board Officers

The new president of Field Museum's Women's Board is Carol (Mrs. Edward F.) Swift, elected at the board's annual meeting, May 4. Mrs. Swift succeeds Nancy (Mrs. Joseph E.) Rich, elected in 1976. Other new officers elected at the meeting were Jean (Mrs. Robert Wells) Carton, vice president; Jocelyn (Mrs. Richard Lea) Kennedy, recording secretary; Jean (Mrs. William H., Jr.) Hartz, corresponding secretary.

Continuing in their respective offices are Margaret (Mrs. Philip D., Jr.) Block and Grace Fuller (Mrs. Donald C.) Greaves, vice presidents; Sara (Mrs. Hammond) Chaffetz, treasurer; Helen (Mrs. Richard L.) Thomas, assistant treasurer.

Marjorie (Mrs. Robert E.) Straus is a newly elected board member-at-large. Continuing as board members-at-large are Barbara (Mrs. Roger O.) Brown, Mary (Mrs. Robert D.) Judson, Nancy (Mrs. Charles Fenger) Nadler, and Mrs. Rolly O. Swearingen.

HISTORICAL PICTURES SERVICE, CHICAGO

# The Archaeologist As Witch

**By Thomas J. Riley**

"How do you know where to dig?" is the question most frequently put to an archaeologist after he delivers a public lecture. As it happens, knowing where to dig *is* the most mysterious part of what an archaeologist does, and the majority of these scientists depend on one sort of magic or another to determine where they are going to strike their shovels into the earth.

For the most part, archaeologists depend on culturally accepted magical ritual. They might employ a magnetometer as an aid in locating underground objects, or they might resort to a table of random numbers to help obtain a valid sample from their site; they might even use a mallet to thump the ground for differential soundings.

A magnetometer measures the intensity of the magnetic field in the earth directly under and surroundings the instrument. If it shows major changes in magnetic field, the investigator knows that there is an obstruction in the ground or that a disturbance of the earth has disrupted normal magnetic alignments. Such changes can be plotted, and they often reveal the presence of the remains of archaeological sites. By means of magnetometry, the archaeologist can thus get a pretty good idea of what a site looks like even before he puts a shovel into the ground. If that isn't magic I don't know what is.

Some archaeologists want to make sure that they get an adequate sample of the materials and features from an archaeological site when they do their digging. In designing their excavations, these researchers resort to numbers magic. After a site is gridded into a set of

---

*Thomas J. Riley is assistant professor of anthropology at the University of Illinois, Urbana-Champaign.*

squares, each square is assigned a random number that is generated from a computer program or obtained from a table of random numbers. A second set of random numbers, chosen from the sample in the first set, tells the archaeologist which squares in his grid to dig in order to obtain an adequate sample of materials and features from the site. This kind of magic is familiar to most archaeologists, though I daresay many are not certain how it works.

Thumping the ground with a mallet may not seem to be the most sophisticated means of discovering where to dig; the technique has been used, however, where the presence of subsurface structures would result in mallet sounds different from those obtained by thumping the surrounding area.

But magnetometers, random numbers, and thumping are not the kinds of magic that concern me here. Some archaeologists, notably historical archaeologists, actually use a more mysterious form of magic—the divining rod—in determining where to excavate. Now divining rods are not considered very scientific, and it's unlikely that a grant proposal to the National Science Foundation to determine where to dig by dowsing would be favorably received. Nonetheless, a number of archaeologists defy the wisdom of NSF and their own peers and do use divining rods in their research.

Archaeologist Ivor Noel Hume is one of these. In his book *Historical Archaeology,* Hume writes that he learned the technique of divining in Europe. He notes that plumbers and electricians in America as well as Europe dowse for buried cable and water pipes with a high degree of success, and that he merely adapted this tool for archaeology. Hume claims that he can find metal objects by divining them, and that the technique is so valuable that at Williamsburg, Virginia, where Hume directs archaeology, no "dig kit" is complete without a set of divining rods.

Hume's divining rod consists of two lengths of ordinary coat hanger, cut and bent into an L-shape, with the long axis of the L about twice as long as the short axis. The short axes of the two rods are held in the hands in such a way that the long axes are parallel to the ground and can swing freely back and forth. With this contraption the surveyor walks slowly back and forth across the site until the two long axes cross one another, apparently uncontrolled by the walker's hands.

When they cross, *bingo,* the surveyor has found the part of the site he is seeking—usually fairly substantial foundations. He may also have found a) water, b) sewer lines, c) electric or telephone cables, d) a large piece of metal, e) any of these, f) none of these.

One of the odd things about divining, claimed by Hume and others, is that men appear to be more "sensitive" to divining rods than women. Hume reports that the rods work for eight of ten men, while only three out of ten women get any reactions from them. This says something either about the nature of divining or about men's common sense compared to that of women.

Does divining work? While Hume says yes (in agreement with thousands of "water witches" and plumbers around the world), a number of authorities say no. The most cogent argument against divining that I know is also one of the oldest. In the sixteenth century, German geologist Georgius Agricola (1494-1555) wrote that only in the hands of experienced miners did divining rods actually turn; and that, he said, was because the rod served as a focus for the miners' trained intuition. According to Agricola,

> a miner, since we think he ought to be a good and serious man, should not make use of an enchanted twig, because if he is prudent and skilled in the natural signs, he understands that a forked stick is of no use to him, for as I have said before, there are the natural indications of the veins which he can see for himself without the help of twigs.

So the battle lines are set, with Hume and the water witches on one side, and all those positivist scientists following Agricola on the other. This is exactly where I stumble innocently onto the stage with my class in "Archaeology and the Public," which I teach at the University of Illinois.

As an exercise in the distinction between archaeology as science and archaeology as magic, I set up an experiment with a "Hume-type coat hanger-divining rod set" to contrast the magic of the divining rod with the predictive value of survey techniques such as magnetometry. My argument was going to be one used by Agri-

HISTORICAL PICTURES SERVICE, CHICAGO

*Above and opposite: demonstrations of dowsing from 16th-century works by German metallurgist Georgius Agricola.*

cola, namely that the divining rod was a focus of the user's subliminal sensory perceptions.

"The diviner acts as a computer," I told my class, "weighing all the sensory elements available to him to find out what's underground. The divining rod, if it works at all, only lets the user bring intuitions based on these subliminal perceptions into play by his subtle and perhaps involuntary movements of the rod."

With this in mind, the students moved outdoors to see what they could dowse. Unfortunately, one of them had worked as a plumber's assistant. He proceeded, by dowsing, to outline the campus's major water mains and their connections to hydrants, buildings, and other structures. I was amazed by the accuracy of his readings.

Still, the basic assumption that the student was working from subliminal sensory inputs remains intact. After all, he had previous experience in locating water mains and sewer pipes and was thus well equipped to perform effectively in this situation.

During the outdoor exercise, I invited a physics professor who was passing by to participate in our experiment. "Hold these like this," I instructed him, "and walk slowly in that direction." Though hesitant at first, he took the rods and did as he was told. As he crossed one of the previously located water mains, the metal rods crossed exactly the way they were supposed to. He was astonished when I told him of his discovery, and he insisted on trying it again—this time with his eyes closed. Bingo! the rods crossed again, just as he crossed a storm sewer line.

"How would you explain that?" I asked.

"You don't," he replied, and walked off thoroughly perplexed, even as I was.

The students and I were faced with something of a problem. I had intended to mention the use of dowsing in archaeology only as an introduction to some of the accepted "magic" employed by most archaeologists. The week before, I had successfully lectured on site prediction, but in my introduction had used an example of radiesthesia—an example which had thoroughly failed.

Radiesthesia is the technique of determining the properties of a particular area on a map by observing the movements of a pendulum suspended over it. A few artifact collectors with a psychic or mystical bent have the idea that sites may be divined by using radiesthesia. They dangle an arrowhead or spearpoint over a U.S. Geological Survey map. When the point begins to rotate, an archaeological site has been discovered. Some of these "sensitives" are supposedly so expert that they can tell exactly what kind of site they have found! If the point rotates clockwise, they have found a site formerly occupied by agricultural peoples; if counterclockwise, the people who lived there were hunters and gatherers.

Radiesthetists appear, from the literature, to have an extremely low rate of success. I would doubt personally that it is much over fifty percent, but that is a personal bias.

At any rate, my demonstration of radiesthesia as a site-predicting tool was a failure. But the experiment was a good introduction to an attempt that we are making at the university to predict site locations by less mystical methods. Using environmental features such as the presence of water, relative differences in elevation, soil drainage, and vegetation, and by evaluating these data in the light of past experience, we can make predictions about the number of archaeological sites to be expected in a given area. There are numerous ways to evaluate the interrelationships of sites and environmental features. The one we chose is known as mathematical regression. This reveals how well certain environmental features and groups of features correlate with the numbers of archaeological sites actually known from an area.

The success rate of initial studies over small areas using mathematical regression has been as high as 68 percent—not good, but considerably above chance. Our successes are really much better than those that can be claimed by the radiesthetists. There is also a major difference between the two methods: Using mathematical regression, we can explain in culturally acceptable terms the distribution of archaeological sites in relation to particular environmental features. We can also evaluate the power of each feature as a site predictor and explain

HISTORICAL PICTURES SERVICE, CHICAGO

*Was Moses divining when he struck the rock with his staff and water flowed from it?*

why it should be important as perhaps a partial cause of site distributions.

So, in the long run we are much better at understanding the operations that we perform than are the radiesthetists, and our tactics for understanding and explaining are well within the realm of normal science. In other words, we know why the method works, while the radiesthetists don't know *if* their method works, let alone *how* it works.

But radiesthesia and divining over a piece of ground are two different approaches, and the simple test of divining that I had conducted with my class apparently worked. It was obviously necessary to devise a test of the technique's efficacy to see if it really worked, and if so, to identify the relevant features of its use.

Does dowsing depend upon a human element, as so many dowsers insist? If not, then we should be able to successfully divine after eliminating the human element. My class and I devised an experiment in which the divining rods were placed through holes in a two-by-four board so that they swung freely. The board was secured to a child's wagon, and the wagon pulled across the quadrangle.

There are several dangers in this kind of experimentation, not the least of which is the credibility loss that a faculty member, a full-grown adult, suffers as he pulls a child's wagon across the campus, with his students trailing faithfully behind. It was even worse when someone stopped to ask what we were up to, and I physically cringed as we passed the College of Liberal Arts and Sciences offices, and saw the dean peering down at us from his window.

This dowsing experiment, like the one using radiesthesia, was a total failure. The rods swung wildly as we went over bumps; not one recognizable crossing of the rods was accomplished. In other words, the rods could not perform without a human mediator.

One more experiment was necessary to test whether or not the human diviner, relying on a set of minimal sensory cues, actually focused his intuition through the rods. For this test we seated an inexperienced diviner, one of my students, facing backwards in the wagon. This eliminated the two most obvious sensory cues: sight and touch. We had earlier reasoned that these were the senses that would most likely be involved in the dowser's art. The same route across the quad was followed as when the rods were attached to the two-by-four; but this time the human diviner kept the rods steadily in back of him. A total of 23 crossings of the rods were made on this run, but less than half coincided with water mains, sewers, cables, or other underground features shown on maps. Of course we may have passed over a number of metal objects and features that didn't appear on our maps; but that was unlikely, because we were dowsing over an area with a concrete surface.

One of two conclusions was possible: either our student dowser was one of those who are not "sensitive," or the technique does not work when the dowser is cut off from the senses of sight and touch. It would appear that the latter was probably the case, and that Agricola was correct when he wrote that a skilled mining engineer could discover ore deposits faster and more accurately than a diviner just by following the natural signs left by an ore deposit in the ground. According to Agricola, the presence of a lead deposit, for example, was usually indicated by shriveled and dwarf vegetation. Obviously, lead poisoning being what it is, that is a natural sign we would expect, and one that the diviner would recognize but be unable to interpret except through his dowsing rod.

I concluded that divining could be considered a nonverbal statement about the conjunction of environmental features that leads the dowser to believe that the

particular objective is at a desired spot. But this explanation leaves quite a lot *unexplained* about dowsing and, for that matter, about other kinds of magic. If dowsing just plain doesn't work, why would it persist within the western tradition for so long? We know that dowsing has been in use at least since the late Middle Ages, and it has been claimed that Moses himself was divining when he struck the rock with his staff and water flowed from it. Obviously, a large number of people must have had at least a little faith in the technique or it would have disappeared as a useful device quite a long time ago. But dowsing has maintained its place of prominence in the folk culture of the most technologically sophisticated society that the world has yet seen. Why?

The same class that did the dowsing experiments responded to a questionnaire on whether our divining had worked in the real sense of being able to discover objects. Of the 21 respondents, six students (29 percent) believed that divining was efficacious in discovering buried objects and archaeological remains. Twelve (57 percent) were convinced that the technique didn't work; three (14 percent) weren't convinced either way.

Strangely enough, when the students were asked about the usefulness of the technique in discovering water, fourteen (67 percent) replied that it was indeed useful, six (29 percent) claimed that it was not, and one student was uncertain. If the response of this class is any indication, divining, at least for water, still holds an important place within our own folk mythology. The anthropologist Omar Kayyam Moore has explored the underlying reasons for the maintenance of magical systems and found some to be explainable in purely utilitarian terms: they work. One such system, he notes, is *scapulamancy*, a divination technique of eastern Canada's Montagnais-Naskapi Indians, who used it to ensure good caribou hunting.

They placed a caribou scapula, or "shoulder blade," in a fire and let it burn. The resultant cracks in the bone were read by a trained shaman, who saw in their design a map of the area where caribou could be hunted. Moore claims that the scapula reading was a randomizing device used by the shaman to make certain that the same areas were not hunted all the time. He thus made certain that the hunters were one step ahead of the caribou, which would tend to avoid areas that had been hunted over and over again.

This would accomplish two things. It would not only maximize the hunters' chances of killing caribou, it would also randomize the danger to caribou social groups; the effect of this would be to maximize their numbers over the entire hunting range. So according to Moore, Montagnais-Naskapi scapulamancy was efficacious in maintaining a balance between big game and big-game hunting economy.

I would argue that water dowsing, and perhaps archaeological dowsing as well, works in a way almost exactly opposite from scapula magic. With an experienced diviner, the almost random chance of encountering water or foundations at an archaeological site (or electric lines for that matter) are minimized, giving dowsing a better-than-even chance of making the right statement about where to dig for the desired underground object or resource.

Dowsing is an exclamatory sentence that uses no words and which is correct more often than wrong—providing it is done by an expert who can read the natural signs. That is why dowsing remains an important tool in the repertoire of today's electrician and engineer and, yes, even the archaeologist. Meanwhile, I will continue using mathematical regression and other analytic methods to gauge the predictive power of features that I can recognize, feel, taste, hear, see, or smell. I want to know why I think a site is where it is and why ancient peoples chose the places they did to build, to live, and to die. If an archaeologist doesn't ask why a site is where it is, his work is of little value. □

THE BETTMAN ARCHIVE INC.

# OUR ENVIRONMENT

### The "Other" Oil Crisis

While the search for new sources of virgin oil intensifies, conservationists are peering at the "double-barreled" nature of the oil crisis to try to figure out what to do about all the oil that is being thrown away, observes Richard Morris, of the National Wildlife Federation.

Many motorists are a significant part of this little-thought-about, throw-away problem. As do-it-yourself oil changers faced with the dilemma of disposing of the slimy substance periodically coaxed from their car's crankcase, these motorists contribute to both environmental pollution and the energy crisis. Some localities are now beginning innovative programs to help.

More than two billion gallons of lubricating oil are sold annually in the United States. According to U.S. Environmental Protection Agency (EPA) estimates, approximately half of this lube oil is consumed or otherwise lost in use. The remaining one billion become "waste oil" after it gets dirty and is replaced. What happens to all this waste oil?

A large amount of waste oil, primarily that taken from use in industrial machinery, is reused, often as a fuel. However, almost 60 percent of the waste oil generated yearly comes from the crankcases of automobiles. Some of this is mixed with virgin fuel oil to be burned for heating purposes. But without proper treatment and proper air pollution control devices, this mixture, which is a few cents a gallon cheaper than pure virgin heating oil, releases contaminating particles to the environment, lowering air quality. The principal contaminant in this case is lead from gasoline additives. Unfortunately, only a small percentage of waste oil used as a fuel is reprocessed, removing the contaminants. However, increasingly tougher restrictions on lead emissions promulgated by EPA are expected to help curtail this form of pollution in the future.

Another 20 percent of waste oil is used in asphalt manufacture to control dust on roads. This application has been found to be environmentally questionable since the oil can eventually leave the road surface in the form of rainwater runoff and contaminate nearby soils and streams. Currently, little more than one-tenth is refined again for reuse as a lubricating oil. A frightening one-third of all the waste oil is unaccounted for. This vast amount is inevitably dumped on the land where it contaminates the soil, and down sewers, where it eventually flows into nearby streams and other bodies of water, spreading its contaminants to drinking supplies and taking a heavy toll on water quality and aquatic life. The largest source of the oil pollution of our waters, according to recent reports, comes from motor vehicle.

Used motor oil is usually collected from service stations by small independent collectors, operating primarily in urban areas. They make their money through collection fees or by selling waste oil to reprocessors or re-refiners. When petroleum prices are high, waste oil is likely to find its way back into use. When the price is not high enough to allow profits for collectors and reprocessors, it will more likely be dumped in the environment.

Extensive efforts to recover this valuable resource are cropping up throughout the country. Last summer, Fairfax County, VA, initiated a used motor oil recycling program designed exclusively to provide an environmentally beneficial disposal alternative for do-it-yourself oil changers. Under this program, motorists who change their own oil are encouraged to bring their old oil in a clean plastic jug or other appropriate container to one of approximately 300 participating service stations and auto supply centers where it will be held in underground storage tanks until it is sold to be re-refined or reprocessed. The program was developed at the modest cost of $300 in a joint effort by the Fairfax County Office of Consumer Affairs, the Northern Virginia Gasoline Retailers Association, and major oil companies. Neighboring Falls Church and Arlington County are readying plans to follow suit. Similar programs are either being developed or are in progress in other areas of the country. For example, used motor oil is being recycled in Minneapolis by one oil company through its service stations there. In Milwaukee, nine oil recycling centers have been set up at municipal yards. And more than 20 states now are exploring the possibility of setting up state-wide used oil recycling programs. Oregon's Used Oil Recycling Act, which took effect at the beginning of this year, declares that ". . . used oil shall be collected and recycled to the maximum extent possible . . . to conserve irreplaceable petroleum resources, preserve and enhance the quality of natural and human environments, and protect public health and welfare."

According to recent figures, almost a third of all motor oil sold in the U.S. is purchased at retail stores, most of it by individuals who change their own oil. Since they traditionally have had no ready avenue for recycling their old oil, they have been stuck with a sticky disposal dilemma. Even sealing used motor oil in a container for eventual disposal in a sanitary landfill is not a comforting solution for the do-it-yourselfer who is also concerned about environmental quality.

Recycling used oil from the service station where it is stored in bulk simplifies the task of collection and therefore makes economic sense. This practice has been on the upswing in recent years with the skyrocketing rise of oil prices. What is necessary now is to bring the do-it-yourselfer into the recycling system.

As late as 1960, more than 150 oil re-refiners were producing some 300 million gallons, or 18 percent of the nation's lube oil. Today, less than 30 companies survive. Many re-refiners blame their decline on governmental actions. These include a 1965 tax law which in effect gave a small but significant advantage to virgin oil use in the

off-highway market (railroad trains, industrial machinery, etc.) and the failure of re-refined lube oil products to meet Defense Department specifications, thus effectively prohibiting government purchase. These developments, along with a Federal Trade Commission ruling requiring a "previously used" label on all re-refined automotive lube oil products, confirmed an image of inferior product quality in the mind of the American consumer.

that oil retains its lubricating properties no matter how much dust, lead, and other impurities it picks up. "Old oil doesn't wear out," they say, "It just gets dirty." And even the dirtiest oil can be re-refined—usually by mixing the oil with sulfuric acid and passing it through clay—into a product often claimed to be equal to and even superior to most virgin lube oils. Even the residual acid sludge may be recyclable, if prices for sulfuric acid and other by-

The Energy Policy and Conservation Act of 1975 specifies that current federal purchasing and labelling policies affecting re-refining motor oil will be reexamined. It also requires the National Bureau of Standards to establish tests to determine equivalency between virgin and re-refined oils. The results from these tests are not yet in; however, preliminary reports from other tests are encouraging. Results from a field test conducted on San Diego public

*Steve Sack*
Courtesy the Minnesota Daily

**". . . Advance token to nearest railroad, derail, spill noxious chemicals, and evacuate all houses and hotels in the nearby vicinity."**

Other factors have also contributed to the difficulties faced by re-refiners. Growing numbers of motorists changing their own oil and a mushrooming of alternative waste oil uses have combined to reduce the flow of waste oil feedstock to the industry. More sophisticated lube oil formulation necessary to produce detergent and multiviscosity oils for high performance engines has made the re-refining process more difficult and more expensive. In addition, the traditional re-refining process itself produces an oily acidic sludge which presents a sticky disposal problem of its own.

Advocates of oil re-refining emphasize what many of us fail to appreciate—

products of the re-refining process continue to rise. Newer methods of re-refining which do not produce the hazardous sludge are in various stages of development and use.

With the advent of the oil crisis and the nationwide focus on energy and resource conservation, the federal government has decided to take a second look at the prospects for waste oil recovery. The re-refining of oil for reuse as a lubricant appears to be the most energy-conserving of all available waste oil utilization options. According to recent EPA figures, as much as 50,000 barrels of oil per day could be saved if waste oil were re-refined to its original use as a lubricant.

works department vehicles showed performance and engine wear after two years (and over 100,000 miles) to be equivalent if not superior for those cars using exclusively re-refined oil as opposed to those using virgin lubricating oil.

In order to stimulate the recycling of used motor oil, the U.S. Department of Energy operates a Used Oil Recycling Program, which handles informational requests and processes grant applications for research and implementation of oil recycling efforts.

In Congress, a bill introduced by Representative Charles Vanik of Ohio, entitled the "National Oil Recycling Act," provides for an internal govern-

ment oil recycling program, grants to states implementing waste oil management plans, the use of resealable containers with mandatory deposits for retail oil sales, and an oil recycling consumer education program.

Economic factors and increasingly stringent environmental regulations are forcing the larger consumers of lubricating oil to cease polluting to just dumping their used oil. If we are ever to close the gap left open by the do-it-yourselfer, concludes Richard Morris, then consumer education will play a key role in the resolution of the "other" oil crisis.

### Mississippi Water Birds Decline

Waterbird colonies along the upper Mississippi River floodplain are declining, according to the conclusions of a year-long pilot study, conducted by biologist David H. Thompson of the University of Wisconsin. Thompson's goal was to determine the colony locations and populations of larger colonial waterbirds nesting within the 4-6 mile wide floodplain of the upper Mississippi River between Minneapolis and St. Louis.

Counts and population estimates were made by two complete aerial surveys, which covered every sandbar, island, and backwater of the 624 mile long study area. After each survey, colonies were visited on the ground to verify population counts, sample vegetation, and look for disturbances. Results of these studies indicate a substantial population decline of great blue herons and egrets in the southern half of the study area, a decline which has probably been occurring over several decades.

Comparison of data showed fewer and smaller colonies in the southern half than the northern half (average 20 nesting pairs per colony in the northern half versus 7 pairs per colony in the southern half). The southernmost great blue heron colony has decreased from 15 to 4 pairs in recent years, and six great egret colonies south of Clinton, IA, have disappeared. Two colonies of cormorants, which are on the endangered species lists of Wisconsin, Illinois, and Missouri, are also known to have disappeared in the southern portion. No new colonies were found. Of the seven colonial species found or formerly occurring, says Thompson, four are declining in population and least terns have probably been extirpated from the study area. Only two species, Forster's terns and yellow-crowned night herons, were found to be expanding their ranges. The great differences in present populations between the two regions, says Thompson, indicate a substantial population decline in the southern half, which is likely to spread to the northern half as development proceeds. Drainage and diking, development of navigation facilities on the river, and the establishment of more industry along its banks is of main concern.

Few undisturbed or undeveloped refuges for herons and egrets are found outside of the Mississippi floodplain, underscoring the significance of Thompson's findings.

The first step toward reversing the population decline, says Thompson, is identification of the causes, and, secondly, designation of critical feeding and nesting areas for preservation and management. Features Thompson identified as critical regarding location of colonies were: tall trees (particularly sycamores) for nesting; proximity to dams, marshland, water, and river junctions; and barriers to human disturbance.

This study was timely since no studies of colony sites and populations of colonial water birds along the upper Mississippi have been published. However, Thompson warns that with only one year's data on hand and incomplete knowledge about populations outside of the floodplain these results should be taken as preliminary. Nevertheless, these findings provide a warning of an advancing environmental degradation of the river and the surrounding floodplain. Says Thompson, "The birds are apparently warning us of an environmental problem in this area, which should be investigated." — *Hermann Sveinbjornsson, Conservation News*

### Slime Saves Time

The mucus on the surface of a fish's skin or scales is a material that sharply cuts friction as the fish speeds through the water. Ship designers are now studying this film, and the way it adheres to fish, to see if a similar system could be made available for ships. Skin friction causes drag on ships, slowing them and forcing greater fuel needs. One artificial material currently under study for this purpose is polyethylene oxide.

### Tree-Savers Outnumber Tree-Sellers, Reports Opinion Poll

A study commissioned by the industry-related American Forest Institute shows that Americans prefer to have forest trees preserved rather than cut for timber, reports the National Wildlife Federation. The study, undertaken to measure attitudes toward forest-related recreation vs. development, especially towards wilderness, was conducted in September, 1977 by the Opinion Research Corporation, Princeton, NJ.

Two thousand members of the general public were surveyed, while 100 Washington, D.C. "thought leaders" were polled. The results: of the 2,000 citizens surveyed, 62 percent preferred the preservation of trees; only 28 percent indicated support for increased timber sales.

Within the ranks of the 100 thought leaders, the vote was much closer—38 percent supported preserving trees while 36 percent favored increased timber sales. The remaining segments of both groups either had "no opinion," supported "both," or were critical of the manner in which the question was phrased. Concerning wilderness, only seven percent of those surveyed thought there is "too much" while 32 percent indicated there is "too little."

Since support for more development was lacking on the part of the general public, the pollsters advised the American Forest Institute to aim its "persuasive efforts" at the Washington thought leaders, since they perceive the issue "more rationally and with greater expertise."

### Ketchup or Mustard with Your Fish Dog?

A new kind of hot dog made from Florida mullet has been developed; it is more nutritious than the conventional hot dog, significantly lower in calories and inexpensive, according to University of Florida food scientists who developed it. Dubbed the sea dog, the sausagelike product has less than 10 percent fat. Ordinary hot dogs with beef and pork may contain as much as 30 percent fat. The sea dog has 148 calories compared to 248 calories in the standard hot dog and 470 in pork sausage.

Mullet was used because of its abundance and low cost. And cost could be reduced even further by substituting soybean vegetable protein for up to 25 percent of the contents, say the researchers.

### Return of the Atlantic Salmon

Once so numerous that there are records of more than 3,000 fish being taken in one haul at Old Saybrook, CT, the Atlantic salmon (*Salmo salar*) has virtually been unknown in the Connecticut River in this century, reports Sandy Spelliscy in *Conservation News*. Now, with the help of an Atlantic salmon restoration program, the anadromous fish may be making a comeback. Following its birth in fresh water, the Atlantic salmon migrates to the ocean, where it spends most of its adult life before returning to its freshwater home, where it breeds and spawns.

As early as 1798, dam construction on the Connecticut River began blocking the salmon's upsteam passage to its freshwater breeding grounds. Naturally, as fewer and fewer salmon spawned, there were no young salmon to take the place of the older ones that died. Gradually, the salmon of the Connecticut River disappeared.

Salmon continued to use tributaries of the Connecticut River for spawning, but in the early 1800s increased pollution from the burgeoning lumber industry and rising human population added to its demise. Raw human and industrial waste made the once-clear river uninhabitable. Soon, the extermination of the Atlantic salmon from the Connecticut River was complete.

In more recent times the Atlantic salmon has faced even greater problems. Already deprived of some of its traditional breeding grounds, lately the salmon has been in jeopardy in its saltwater habitat as well.

For hundreds of years the migration patterns of the salmon remained a mystery. Only in the last 50 years has it been discovered that between the time they leave their freshwater homes and return years later to mate and spawn, many salmon travel thousands of miles in journeys across the oceans.

Following the salmon's seaward migration, which enables it to find adequate food supplies, its ocean stay makes it vulnerable to international commercial fish harvesting. In the late 1950s, large salmon shoals were found off the west coast of Greenland. Danish fishing companies set up highly productive and profitable fisheries in the area, thus depleting salmon stocks thousands of miles from their original river birthplace.

Closer to home, practices of driftnetting and inshore coastal netting along salmon migratory routes further threatened the future of the species. In areas off the Irish and English coasts and off Newfoundland, salmon bound for Canada's Maritime Provinces and New England had their journeys cut short.

Then in 1966, a salmon restoration program for the Connecticut River was initiated. Fishery agency directors from Connecticut, Massachusetts, New Hampshire, and Vermont, along with regional directors of the U.S. Fish and Wildlife Service and members of the National Marine Fisheries Service met to devise a plan for bringing the Atlantic salmon back to the Connecticut River. First, a series of fish passageways were constructed to help the salmon get past the dams along the river. Also, hatcheries were built that bred salmon for stocking upstream from the hydroelectric plants. In 1975 and 1976, four federal hatcheries and four state hatcheries produced more than 200,000 salmon smolts (two-year olds) and fry (recently hatched) for the Connecticut River program. These efforts have produced positive results. Between 1975 and 1976, five adult salmon were found in the Connecticut River. Two of these were caught and used for breeding. In 1977 seven Atlantic salmon were found to have made their way up the Connecticut River; this time four more were caught for breeding purposes.

Additionally, the river's severe pollution problem has been alleviated in recent years. Increased concern over pollution in the nation's waterways has brought about legislation that has led to improvement of water quality in the Connecticut River so that today most of it is suitable salmon habitat.

On the international scene, several developments have contributed to salmon preservation. First, U.S. legislation passed in 1971, the Pelly amendment, imposed a ban on imports from nations that failed to practice "acceptable fishery conservation programs." This pressure was enough to convince Denmark to agree to phase out its salmon fishing in international waters by 1976. In 1977 the U.S. Congress moved to extend American jurisdiction over fishing to 200 miles, thus protecting those salmon within U.S. coastal areas. In addition, the Law of the Sea Conference continues to meet to work out the international political problems involved in Atlantic salmon preservation.

*Berthold Laufer at about age 30*

# Buddhism and Taoism In Chinese Sculpture

## A Curious Evolution in Religious Motif

**By Art Pontynen**

In 1908, Berthold Laufer, Field Museum's newly appointed assistant curator of Asian ethnology, embarked on an expedition to the Orient, sponsored by the Museum and financed largely by Mrs. T. B. Blackstone, widow of a railroad magnate. Laufer's mission was to acquire cultural artifacts for the Museum, and the Chinese sculptures that may be seen today in Hall 24 are testimony to Laufer's highly productive venture.

The expedition occurred at a time when travel of any sort in the Orient was arduous at best, and the sophisticated traveler was constantly alert to situations that might prove hazardous. This aspect of Laufer's trip is dealt with in "Journey into Tibet," which appeared in the June, 1974, *Bulletin* (Vol. 45, No. 6). But an equally interesting aspect of the "Mrs. T. B. Blackstone Expedition to China and Tibet, 1908-10" concerns the artifacts which were the very reason for the journey. These pieces give us a glimpse in miniature of Chinese history, beginning with the fifth century A.D., and show us just how effective Laufer was in locating significant works of art from China's major historic periods.

Exploration of China by European ethnologists was at its height during the years just before and just after World War I. Among those who achieved renown as the result of their China ventures included Albert von Le Coq, of Germany; Paul Pelliot, of France; and Hungarian-born Mark Aurel Stein, who became a British subject. But Americans were equally active in acquiring and preserving artifacts from the Orient, among them Langdon Warner who, in 1924, collected in China on behalf of Harvard's Fogg Museum. In his book *The Long Old Road in China* (1927), Warner summed up the situation:

> Before the study fire in Cambridge it had been simple enough for Horace Jayne [a Philadelphia museum curator] and me to compute the possibilities of success. There lay Marco Polo, Pelliot's notes on the Cave of the Thousand Buddhas, and Stein. . . but now, in the drab bedroom of the hotel in Peking, the flush of certainty paled. Maps, saddle bags, typewriters, and the varied equipment of a summer and winter campaign lay about us in disorder. Again we

*Art Pontynen is a doctoral candidate in Chinese and Japanese art history at the University of Iowa.*

*Fragmentary votive stone which could be either Buddhist or Taoist; about A.D. 421. Cat. No. 121393.*

> reviewed our problem. Bandits on the Honan border; Mohammedans violent in Kansu; . . . rains and seas of mud at first—then droughts and bitter desert cold. But imagination flouts the counsels of prudence . . . the splendour, squalor, suffering, and accomplishment of travel older than history—stood always before our eyes and would not be denied.

Laufer, who preceded Warner into China by two decades, might have described his own experience with much the same apprehensions, fears, and desires.

In 1907, while serving as an assistant at the American Museum of Natural History, Laufer was approached by George Dorsey, then Field Museum's curator of anthropology, about collecting in the Philippines for Field Museum. Laufer replied that an expedition to Tibet would be of greater value to the Museum and that he was actually better informed about Tibetan culture (having specialized in this area while a doctoral candidate at the University of Leipzig).

In June, 1907, Dorsey wrote back that he was agreeable to the Tibet proposal, and in November funding was secured, thanks to Mrs. Blackstone's generosity. By January, 1908, Laufer was aboard ship, bound for the Orient via Europe. Making stops in Germany, India, Ceylon, and Japan, he arrived in China the following November. In Peking he made final preparations for the journey to Tibet, more than 1,000 miles to the southwest.

The first leg of the overland journey was an uneventful, two-day rail trip to T'ai-Yuan-Fu in Shansi Province, followed by a two-week journey by mule cart to Sian (also known as Hsian-Fu, or Siking), China's capital during the T'ang dynasty (A.D. 618-907) and a city rich in history. He stayed briefly in Sian, spent two months in Ch'eng-Tu, in Szechuan province, and by late May crossed at last into Tibet.

After about six months of collecting there, he retraced his route, arriving in Sian again in early February, five days before the Chinese New Year. This was the best time of year for the collector, because according to Chinese tradition, debts had to be settled by New Year's Eve, and it was then that heirlooms and other treasures were suddenly offered up for sale. Laufer wrote Dorsey of the experience:

> The result of these five days' hard battle is: a collection of about 1,100 choicest and most brilliant antiquities, most of them unique pieces. There is nothing in this lot that you would be apt to find in the curio-shops of Peking and Shanghai. The objects are either the results of excavations, or heirlooms of wealthy families. Most of the latter would

*Taoist sculpture, about A.D. 502. The feather fan is typically Taoist. Cat. No. 121390.*

*Buddhist stele, about A.D. 519, with characteristic graceful flowing lines. Cat. No. 121418.*

never have come to light but for the pressure of New-Year, and there are such grand and adorable works of art among them that neither myself nor the oldest and smartest art dealers of Hsianfu have ever seen before anything similar. It is useless to send photos or descriptions of these pieces; they must be seen to be appreciated."

Now Laufer's acquisitions may both be seen and appreciated; many are on display in Hall 24. They include numerous fine early ceramics, bronzes, cast iron pieces, earthenware figurines, and so forth. But perhaps the most interesting of all (and certainly among the unique in terms of the holdings of other American museums) are the stone statues and reliefs displayed in the cases at the north end of the hall. It is one of the larger collections of early Chinese sculpture. And it illustrates with special clarity the complex artistic interconnections between the two great religions of China, Taoism and Buddhism.

The earliest of these (page 17) a broken votive stone also identified by its inscription as a Buddhist icon, is dated to A.D. 421. Though the stone is badly damaged and worn, there are still a number of clues to its identity. Dominating the center is a large human figure; to one side is a smaller figure. The corresponding figure flanking the other side is now gone. Above the original triad had been two serpentlike dragons; only their tails remain today Numerous examples of this type of Chinese sculpture are known, but none other is dated so early.

In apparent reference to such an object, the eminent Oriental art historian Osvald Siren observed:

> These objects are Taoist, though in many cases they are combined with Buddhist inscriptions which are not always of a contemporary or authentic kind. Some of them are dated in the third decade of the sixth century, but others are provided with earlier, obviously invented dates. The compositions usually consist of three figures placed in a flat niche or simply against a background slab which is framed

*Taoist stele, about A.D. 564. Flanking the figure of Lao Tzu are Buddhist bodhisattvas. Cat. No. 121452.*

121452

at the top by two intertwined serpentlike dragons. . . .

The passivity of the central figure belies the controversy now attending it. Is the piece Buddhist or Taoist? Is the inscription genuine or, as Siren suggests is often the case, is it a later addition to an already ancient and important object? For our present concern, however, these questions need only be raised, not answered, though some explanation of how this confusion could have occurred is perhaps in order:

A basic concept of Buddhism, which was founded in India, is reincarnation, the doctrine that the soul does not die, but transmigrates from one animal form to another depending upon the good or bad deeds of one's lifetime. In later Buddhism, the theory evolved that if one performed sufficient good during a lifetime or series of lifetimes, then he or she would escape reincarnation and attain Nirvana, the bliss of paradise. This religion spread to China at least as early as the second century A.D. Taoism, which originated in China, had an early philosophical phase, followed by a quasi-religious phase. The latter is reflected in Chinese Taoist sculpture of the type that concerns us here. As early as the second century B.C. the writings of Lao Tzu and other mystics began to be formalized into a religion, Taoism, one of whose chief goals was the attainment of personal immortality. Taoists came to believe in a bewilderingly complex hierarchy of divinities. By the second century A.D., possibly under the influence of Buddhism, they began to make statues of these divinities.

The oldest known Taoist image (now lost) was a figure of Lao Tzu set up in A.D. 158 by the Han emperor. During the Wu dynasty (A.D. 220-80) the first Taoist temples were set up with images of Lao Tzu, but not until the Liu Sung period (A.D. 420-79) were the cult's elaborate rules concerning sacrifices, charms, and altars established. It is from this period that the practice of making Taoist images of T'ien Tsun ("The Emperor of Heaven") and Lao Chun ("The Venerable Prince," one of Lao Tzu's titles) began.

*Taoist god of creation, about A.D. 665, flanked by ordinary humans. Cat. No. 121524.*

The apparent confusion between Buddhism and Taoism may be in part due to Chinese attempts to explain Buddhist concepts with Taoist terminology. The sophisticated philosophical and religious terminology of India was difficult to translate accurately into Chinese, which had very few comparable terms. Many early Chinese Buddhists had first been trained as Taoists, so it was natural for them to draw upon Taoist thought when expressing the new concepts. One such Taoist-turned-Buddhist was Seng Chao, a Sian-area native who wrote a famous Buddhist text, the *Book of Chao.* The language of Chao's book is largely Taoist, and Lao Tzu is often quoted.

Political elements further obscured the differences between the philosophy and art of these two religions. As the art historian Matsubara Sabaro has expressed it:

> [There are some examples of sculpture] which cannot yet be attributed either to Buddhism or Taoism. . . . Their characteristics were probably affected by the abolishment of Buddhism in the Northern Wei period [A.D. 386-535], which fact could be confirmed by the history of Taoism in China also. Buddhism, after its abolishment, was forced to degenerate into a so-called underground religion. Hence the result was that Buddhist images appeared in rural districts far from the central government, assuming the disguised form of Taoist images.

While the sculpture shown on page 17 may be either Buddhist or Taoist, a later image (page 18, left) dated probably to A.D. 502 is unquestionably Taoist. Although similar to a number of existing Buddhist sculptures of similar time and provenience, several distinctly Taoist elements are recognizable in this piece. In place of a bulge on the top of the head—identifying the figure as a representation of Buddha—this image is capped. The figure's

*Berthold Laufer. Above: in 1920s, holding Chinese drinking vessel carved from rhinoceros horn. Below: in Tibet in 1909. His companion, a high-ranking Tibetan woman, is unidentified. An unusual pose for the usually strait-laced Laufer; his right arm rests on a sword and he sports a cigar.*

right hand is not in one of the characteristic poses of the Indian vocabulary of gestures, but rather holds a Chinese style feather fan, a symbol favored by Taoists. This single image cannot of course be considered representative of all Taoist art produced at this time. Nevertheless, in comparison with a Buddhist stele of the same period (dated to A.D. 519), it seems clear that Buddhists of that time were producing icons of the highest quality. This stele (page 18, right) is rendered in the characteristic Northern Wei style, notable as a highly successful expression of religiosity; it is also notable for its beautifully flowing lines. The slightly elongated figures are garbed in elegant robes; that of the main figure cascades over the throne in a splayed swallowtail fashion, and the total effect is one of profound spiritual ease.

Later Taoist images show a continued interest in the development of a distinct symbolic vocabulary. A stele dated to A.D. 564 (page 19) is possibly the earliest surviving representation of a deified Lao Tzu. Although this development is a significant step in the evolution of Taoist art, the stele itself is nearly indistinguishable from Buddhist pieces. Flanking the figure of Lao Tzu are bodhisattvas, saintlike Buddhist figures who are particularly incongruous as companions to a Taoist image. This idiosyncrasy did not escape the scrutiny of contemporaries; in A.D. 570, a certain Chen Luan presented an address to the throne in which he ridiculed Taoists who "make statues of Lao Tzu, with a bodhisattva on each side."

With the T'ang dynasty, the quality of Taoist sculpture reached a new high. This is undoubtedly linked to the fact that the T'ang dynasty's founding family bore the surname Li, the same as Lao Tzu's. Because of this coincidence, Taoism received imperial favor—a favoritism that seems to be reflected in the A.D. 665 image shown on page 20. Here the god of creation is on a throne. In his right hand he holds a fan of feathers or of deer's tail—an early iconographic invention; and he is seated behind a three-legged arm-rest—considered to be a mid-sixth century innovation—and presented very much in the manner of a scholar, prepared to discuss philosophy. Significantly, the flanking figures are no longer bodhisattvas, but ordinary mortals paying homage to the deity.

These observations, however, do no more than scratch the surface of the rich lode of information contained in Laufer's collection of Chinese sculpture. Many articles could be written just on what it tells us about the development of religious art in China, and about artistic symbolism, regional styles, sectarian beliefs, and the connections between religion, art, and politics. Whether Laufer himself envisioned all this is not known—he rarely made notes on exactly why he chose particular kinds of statues and other objects. But even if it was chance as much as foresight, he had an inspired kind of luck. It produced a collection which is one of Chicago's treasures, for the scholar and the museum-goer alike. □

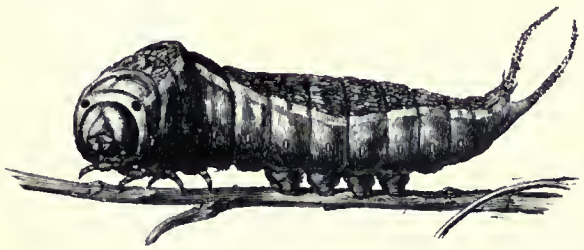
*The artifacts acquired by Berthold Laufer during his four visits to the Orient included a great many items related to the theater arts. The above mask (19th century) is one of the more remarkable. It represents a certain Yang Jen who, according to legend, was blinded as punishment by the emperor Chou Wang. By means of a charm, however, Yang Jen was able to grow a tiny pair of arms from his eye sockets, and a new pair of functional eyes appeared on the palm of each new hand. The new eyes were able to perceive all things in heaven and earth. Cat. No. 120632.*

# *June and July at Field Museum*

*(June 15 through July 15)*

### Last Chance to See

**Folk Art in China;** closes July 5. A special exhibit of approximately 150 utilitarian and symbolic objects dating from mid-15th to early 20th century China. Each artifact expresses the underlying characteristic of its period. Included in the exhibit are woodblock prints, textiles, bamboo furniture, tile engravings, folk paintings, paper crafts, statues, lacquered leathers, and metalwork. Hall 27.



### New Exhibits

**Yoruk: Nomadic Weaving Tradition of the Middle East**—opens June 23. The great art of the nomads—the making of fabrics from wool—comes to Field Museum in an important exhibit of approximately 110 weavings, mostly Persian and Afghanistanian carpets, saddlebags, and tent trappings. This exhibit attempts to preserve the weaving tradition of a rapidly vanishing culture. Hall 26; through August 22.

**Friend or Foe? The Anthropology (Botany, Geology, and Zoology) Game;** just opened. Field Museum's popular *Anthropology Game* has now been expanded to include the museum's three other scientific departments. The object here is to determine which one of a pair of similar appearing specimens is harmful and which is not. Some of the more dangerous playing elements include: a vampire bat, a headhunter's axe, a poisonous mineral, and a deadly mushroom. Ground floor; no closing date.

### New Program

**To and Fro: Migration of North American Animals;** through August 31. This newest self-guided tour leads families and children through museum exhibits to illustrate the behavior of migrating animals. Free *Journey* pamphlets are available at the information booth, main floor. Bring pen or pencil.

### Continuing Exhibits

**Locks from Iran: A Key to a Culture;** through July 30. A unique exhibit of 463 gold, bronze, and steel padlocks from Iran, surveying 16 centuries of lock-making. The exhibit is being circulated by the Smithsonian Institution Traveling Exhibition Service (SITES).

**Field Museum Gamelan.** Field Museum's 19th-century Javanese gamelan, an ensemble of 24 fine bronze and wood musical instruments, has been completely restored for exhibition. It is the oldest and perhaps finest gamelan outside Indonesia. Hall K, ground floor.

*Calendar continued on back cover*

# *June and July at Field Museum*

*(CALENDAR continued from inside back cover)*

**Pawnee Earth Lodge.** This exhibit, in Hall 5, is a traditionally made Pawnee earth lodge—the home and ceremonial center of Pawnee Indians as it existed in the mid-1800s. Daily programs provide the opportunity to learn about Pawnee culture. Public program hours: Monday through Friday, 1:15 p.m.; weekends, 11 a.m. and 1:15 p.m. Tickets may be obtained 15 minutes prior to the program at the north information booth. Programs limited to 30 people.

**The Place for Wonder.** This gallery provides a place to handle, sort, and compare artifacts and specimens. Weekdays, 1 p.m. to 3 p.m.; weekends, 10 a.m. to noon and 1 p.m. to 3 p.m. Ground floor, near elevator.

*Turkmen woman's cape, on view with other Middle Eastern weavings in Hall 26. Cape lent by Adrienne Harris Pitts.*

### Continuing Programs

**On Your Own at Field Museum.** Self-guided tour booklets, adult- and family-oriented, are available for 25¢ each at the entrance to the Museum Shop, main floor north.

**Weekend Discovery Programs.** Guided tours, demonstrations, and participatory activities. Every Saturday and Sunday, 10 a.m. to 3 p.m.

**The Ancient Art of Weaving.** Demonstrations every Monday, Wednesday, and Friday, 10 a.m. to noon. South Lounge, 2nd floor.

**Audio Information System.** Uniguide audio receivers and maps available for $1.25 per person, $3.75 for a family of up to five at the entrance to the Museum Shop, main floor north.

### June and July Hours

**The Museum Opens** daily at 9 a.m. and closes at 6 p.m. every day except Friday. On Fridays the museum is open to 9 p.m.

**The Museum Library** is open weekdays 9 a.m. to 4 p.m. Obtain a pass at reception desk, main floor.

**Museum telephone:** (312) 922-9410.

. . .

July/August
1978

Field Museum of Natural History Bulletin

# Field Museum of Natural History Bulletin

July/August 1978
Vol. 49, No. 7

*Editor/Designer:* **David M. Walsten**
*Production:* **Oscar Anderson**
*Calendar:* **Mary Cassai**
*Staff photographer:* **Ron Testa**



## Field Museum of Natural History
Founded 1893

*President and Director:* **E. Leland Webber**

BOARD OF TRUSTEES

William G. Swartchild, Jr., *chairman*
Mrs. T. Stanton Armour
Goerge R. Baker
Robert O. Bass
Gordon Bent
Harry O. Bercher
Bowen Blair
Stanton R. Cook
O. C. Davis
William R. Dickinson, Jr.
Thomas E. Donnelley II
Marshall Field
Nicholas Galitzine
Paul W. Goodrich
Hugo J. Melvoin
William H. Mitchell
Charles F. Murphy, Jr.
James J. O'Connor
James H. Ransom
John S. Runnells
William L. Searle
Edward Byron Smith
Robert H. Strotz
John W. Sullivan
Mrs. Edward F. Swift
Edward R. Telling
Mrs. Theodore D. Tieken
E. Leland Webber
Julian B. Wilkins
Blaine J. Yarrington

LIFE TRUSTEES

William McCormick Blair
Joseph N. Field
Clifford C. Gregg
Samuel Insull, Jr.
William V. Kahler
Remick McDowell
James L. Palmer
John T. Pirie, Jr.
Donald Richards
John M. Simpson
J. Howard Wood


## CONTENTS


3 **Our Environment**

4 **Archaeology in the Electronics Age**
*By Robert A. Feldman and Alan Louis Kolata*

11 **A Festival of Anthropology on Film: Program Schedule**

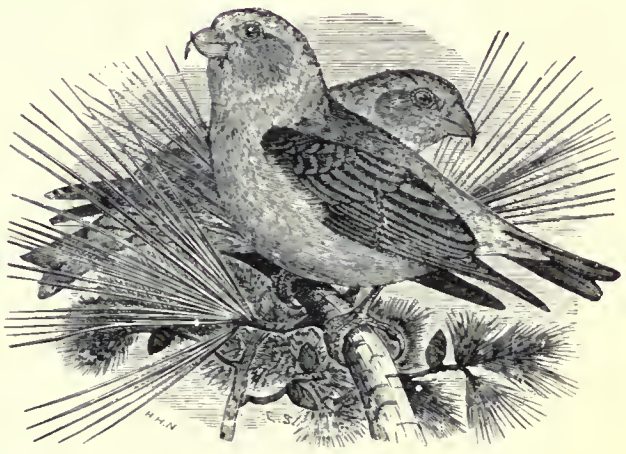
15 **Natural History Quiz**
*By Ken Grabowski*

16 **A Festival of Anthropology on Film**
*By Ira S. Jacknis and Jane E. Swanson*

23 **July, August, and September at Field Museum**
Calendar of Coming Events


## COVER

*Front cover: Salt bag of the Lor tribe, southwestern Iran; 75×47.5 cm. On view through August 22 in Hall 26 with 110 other examples of weaving in temporary exhibit, "Yoruk: Nomadic Weaving of the Middle East." This salt bag has been lent for the exhibit by John and Suzan Wertime, Arlington, Va.*
*Back cover: Salt bag of the Bakhtiari tribe, southwestern Iran; 57×47.5 cm. Lent for the exhibit by John and Suzan Wertime.*




*Field Museum of Natural History Bulletin* is published monthly, except combined July/August issue, by Field Museum of Natural History, Roosevelt Road at Lake Shore Drive, Chicago, Il. 60605. Subscriptions: $6 a year; $3 a year for schools. Museum membership includes *Bulletin* subscription. Opinions expressed by authors are their own and do not necessariy reflect the policy of Field Museum. Unsolicited manuscripts are welcome. Postmaster: Please send form 3579 to Field Museum of Natural History, Roosevelt Road at Lake Shore Drive, Chicago Il. 60605. ISSN: 0015-0703.

# OUR ENVIRONMENT

### Thirteen Plants Added to Endangered and Threatened Lists

Thirteen plants inhabiting fragile and unique ecological niches in 12 States and Canada have been listed as endangered or threatened by the U.S. Fish and Wildlife Service. Final rulemaking was published in the April 21, 1978, *Federal Register.* This is the second formal listing of plants under the Endangered Species Act of 1973; the first, in August 1977, listed as endangered four plants native to San Clemente Island off the Southern California coast.

The value of the 13 plants to man—challenged by some—is scientific and possibly economic. Clues are contained among these 13 plants to such questions as how Hawaii evolved and how Asian plants migrated to this continent. All 13 are integral to unique ecosystems and some have endangered life forms as neighbors. Although the plants are listed in 12 states, no large land areas are involved.

Two of the plants are listed as threatened and 11 as endangered. The threatened plants and their states are:

**Iowa, Wisconsin, Ohio, New York**—Northern wild monkshood, *Aconitum noveboracense*, in the buttercup family and found only in the driftless area of Iowa and Wisconsin, as well as in Ohio and New York. Driftless areas are those that were surrounded but untouched by ice-age glaciers. The populations have been separated since the ice age, and the plant has not spread out of these isolated areas in 10,000 years.

**Utah**—The Rydberg milkvetch, *Astragalus perianus*, is a member of the pea family. It was thought to be extinct. It has not been collected since 1905, when railroad construction through western territories and broader interests in geological surveys brought botanists for field study. It was recently found by a scientist in Utah and is known from only two populations. The area of one population has a dirt road running through it and is also leased for grazing.

The 11 endangered plants are:

**Maine**—The Furbish lousewort, *Pedicularis furbishiae*, was rediscovered along the upper portion of the St. John River in Maine in 1976, the first collection since 1943. It was thought extinct. In 1977 more plants were found, including some in New Brunswick, Canada. The continued existence of the plant depends upon maintaining its habitat along the scenic St. John River. Protecting the species will also contribute to the continued existence of other rare plants in the areas, many of which are at the extreme limit of their distribution and, as such, have distinctive gene pools. Forty percent of the 880 known specimens occur within the impoundment area of the proposed Dickey-Lincoln School Lakes project.

**Georgia**—The hairy rattleweed, *Baptisia arachnifera*, a nitrogen-fixing legume, is found only in a few square miles of the coastal plain of Georgia. It is an unusual pea family member because its leaves have evolved from compound leaves to a single leaflet, and the plant has developed a cobweb of wooly hairs which give it a silvery color.

**Virginia**—The Virginia round-leaf birch, *Retual uber*, was rediscovered in 1975 after being unknown for 60 years. Today a dozen trees occur along a single creek in Smyth County, Virginia. It is distinctive because it is one of three or four species of birch with wintergreen-scented bark. As such, this trait parallels many Southeastern U.S. plants whose nearest relatives are found only in Japan and East Asia.

**Georgia, South Carolina**—The persistent trillium, *Trillium persistens*, a showy, three-leafed wildflower of early summer, is restricted to an area less than 4 miles in diameter in Georgia and South Carolina. The main population is in a gorge which has been affected by trail construction and the use of the area as an outdoor amphitheater. It is an unusual spring flower because it remains green and active more than a month after other trilliums go dormant.

**California**—The Santa Barbara Island liveforever, *Dudleya traskiae*, a member of the stonecrop family, is confined to one of the Channel Islands off California. It was thought to be extinct due to extensive vegetation losses caused by introduced hares. As the hares' numbers were reduced, a few sprouts of the dudleya began to grow from surviving rootstocks. Since that discovery, one inaccessible portion of a cliff with healthy plants has been identified.

**California**—The Contra Costa wallflower, *Erysimum capitatum* var. *angustatum*, and the Antioch Dunes evening primrose, *Oenothera deltoides* ssp. *howellii*, occur only in sand dunes near Antioch, California. The first is a member of the mustard family, the second of the evening primrose family. The name wallflower relates to its relatives which are grown in English gardens near walls as protection against frost. The Antioch Dunes once covered nearly 500 acres, but industrial, agricultural, and urban developments have reduced them to less than 50 acres.

**California**—The Eureka evening primrose, *Oenothera avita* ssp. *eurekensis*, and the Eureka dune grass, *Swallenia alexandrae*, a unique grass genus, are native only to the Eureka Valley of California. The plants and their habitat were greatly threatened by off-road vehicles until the area was closed to such activities by the Bureau of Land Management. Enforcement is still needed. The Eureka dune grass does not fit clearly into any single subgroup of the grass family. Its evolution may be linked to the occurrence of other unusual grasses from Mexico. Several other plants and insects are known only from this general area.

*Continued on p. 9*

# ARCHAEOLOGY IN THE ELECTRONICS AGE

## *Electronic "dowsers" prove their mettle in locating the remains of ancient Peruvian cultures*

By Robert A. Feldman
and Alan Louis Kolata

LAST SUMMER saw the Field Museum's Programa Riego Antiguo (Ancient Irrigation Project) begin a new phase of archaeological research in South America: the determination of subsurface features without excavation. This feat is accomplished neither with dowsing rods nor by means of clairvoyance, but with highly sophisticated electronic tools—products of Soiltest, Inc., of Evanston, Ill., which has lent them to Field Museum for this project.

Now in its third year, the Programa Riego Antiguo (PRA) is a multidisciplinary project designed to study the prehistoric irrigation system in the Moche Valley of Peru, located along that country's northwest coast. By supplementing basic archaeological data of the region with information on its geology, hydrology, and palynology (the study of pollen), we are seeking to understand the physical and political nature of the water and land management practices of the people who inhabited the valley centuries ago. The project focuses on the area around Trujillo, modern Peru's fourth largest city but in centuries past the capital of the Moche (*ca.* 100 B.C. to 700 A.D.) and Chimu (*ca.* 800 to 1470 A.D.) empires.

Two instruments are being used in our subsurface survey program: a seismograph and a device for measuring electrical resistance in the earth. The portable seismograph,

Robert Feldman

*Auger, used to check the accuracy of the earth resistivity meter and seismograph, illustrates the depth of soil build-up along the Wiscansao Canal. Without the electronic instruments, it would have been necessary to dig a test pit by hand.*

---

*Robert A. Feldman is a research archaeologist, P.R.A. Alan Louis Kolata is archaeological consultant, P.R.A.-Soiltest Program and Tiwanaku-Soiltest Program.*

basically a highly sophisticated stopwatch which measures time in ten-thousandths of a second, is used to time shock waves traveling through the earth. This speed varies with different soils: for example, shock waves travel at about 1,500 feet per second through "normal" soil and at more than 10,000 feet per second through rock.

The earth resistivity meter measures variations in the soil's electrical resistivity according to its composition, density, and water content. Loose, dry sand offers very high resistance to an electrical current while wetter agricultural soil has a low resistance.

Through a series of calculations, these instruments' measurements of seismic velocity or electrical resistance can be converted to measurements of the thicknesses of the various layers of soil producing the different readings. By testing an area with both devices we can measure two distinct properties of the earth's layers and arrive at two calculations of the depths to which they go. One instrument provides a check on the other.

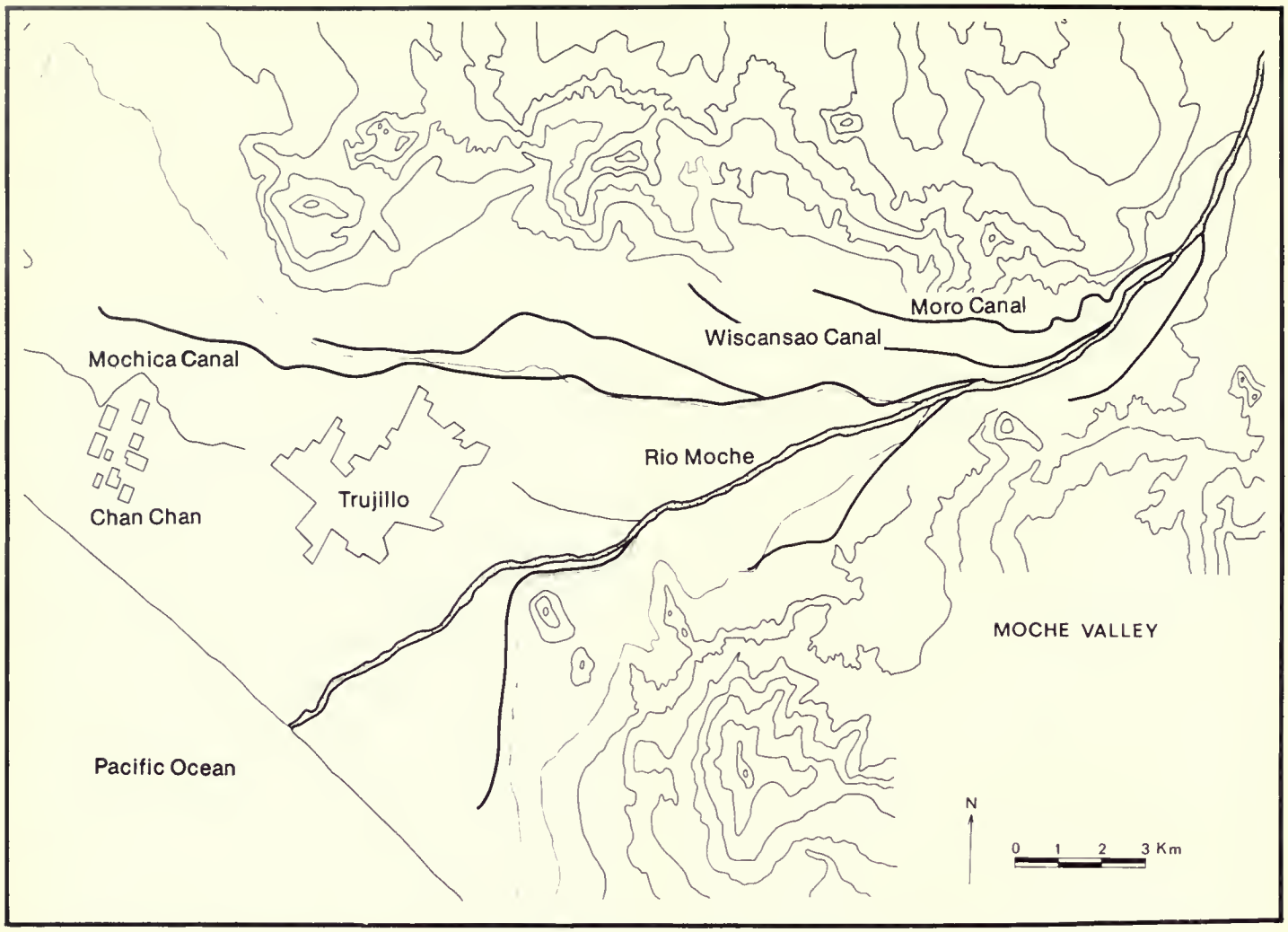
The rivers that come down from the high Andes to the Pacific carry water that makes agriculture possible on the harsh desert coast. They also carry a load of suspended silt which, carried by the water, enters the irrigation canals, where it can settle out. Unless the canal is cleaned periodically, it would eventually fill in with this deposited silt. From these observations, we had hypothesized that silt deposited from the irrigation waters would tend to reinforce the placement of a canal. Silt thrown out of canals during periodic cleanings would build up the banks. The growing canal banks, in turn, would trap erosion materials, building up the ground surface of the fields near the canals. As a result, new canals should follow the built-up path of older ones.

The subsurface survey, using the two instruments, tested this hypothesis by measuring the amount of soil build-up around the major canals. The instruments proved themselves to be useful, and the results we obtained with them confirmed our hypothesis. What surprised us, though, was how great this build-up had been: in places it was over 6 meters (almost 20 feet). To dig a test pit to that depth with pick and shovel would not only require a great amount of time and money, but would also be extremely hazardous to the diggers. However, by using the seismograph and resistivity meter, it was possible to do two complete sets of tests and map the test site in an easy day's work. Since we were uncertain how well the instruments would work for our purposes, we also had a small test hole bored with a hand auger to check their results. We were pleased to find that the auger confirmed the instrument readings.

We began our instrument survey in the middle sections of the Moche Valley along a modern canal called the Wiscansao. We knew that the Wiscansao had also been a major irrigation channel in ancient times. Like other prehistoric

*The seismograph's small size and easy portability make it ideal for rapid survey. The shock waves it records are generated by pounding the ground with a sledgehammer.*

Robert Feldman




*Map of the lower Moche Valley, showing the principal modern canals. These canals are shortened versions of ancient pre-Columbian canals.*

canals in the valley that are still being used, the Wiscansao runs on the crest of a terrace which, in the case of this canal, is some four meters (about 13 feet) high. The purpose of our survey here was to determine whether this terrace was a natural geological feature present prior to initial construction of the old Wiscansao, or "artifically" formed by a gradual deposition of silt over centuries of use, or perhaps a combination of the two.

If the terrace were entirely natural—a *geological* pheonomenon—we would expect the "basement stratum," consisting of dry, rocky soil (with high seismic velocity and low electrical resistance) to be stepped and to occur at the same depth below the present surface on both the upper and lower sides of the canal. But if the terrace were entirely artificial—an *archeological* phenomenon—we would expect this basement stratum to remain relatively level and, therefore, be deeper below the surface on the upper side of the canal by an amount about equal to the visible elevation of the terrace.

We did three separate test runs with the instruments parallel to the canal, and on both its "upper" and "lower" sides (*i.e.*, on the crest and at the base of the terrace). Upon completing these tests, we discovered that the basement stratum on the lower side of the canal was at a depth of about 3.25 meters, while on the upper side (on the crest of the terrace), the depth to this layer was about 5.25 meters. This meant that the ancient Wiscansao was originally constructed on a natural terrace some 2 meters high. Through time, erosion materials washing down from above the canal were trapped behind its banks, gradually reaching a present depth of over 5 meters. Below the canal, without a similar "soil trap," the silt build-up was much smaller—just over 3 meters. We concluded, then, that the terrace carrying the Wiscansao was composed of *both* natural and artifical features.

Our instrument tests have given us insight into the history of soil development around canals and some understanding of the strategy of canal placement practiced by the engineers of these waterworks in ancient times. It is clear that the designers of the original Wiscansao took advantage of the elevational difference between the natural terrace and the surrounding landscape in sighting this canal.

Tests along other ancient Peruvian canals revealed

*P.R.A. codirector Thomas Pozorski probes for a buried canal with the earth resistivity meter. This instrument and the seismograph shown on p. 5 were on loan from Soiltest, Inc., of Evanston, Ill.*

Shelia Pozorski

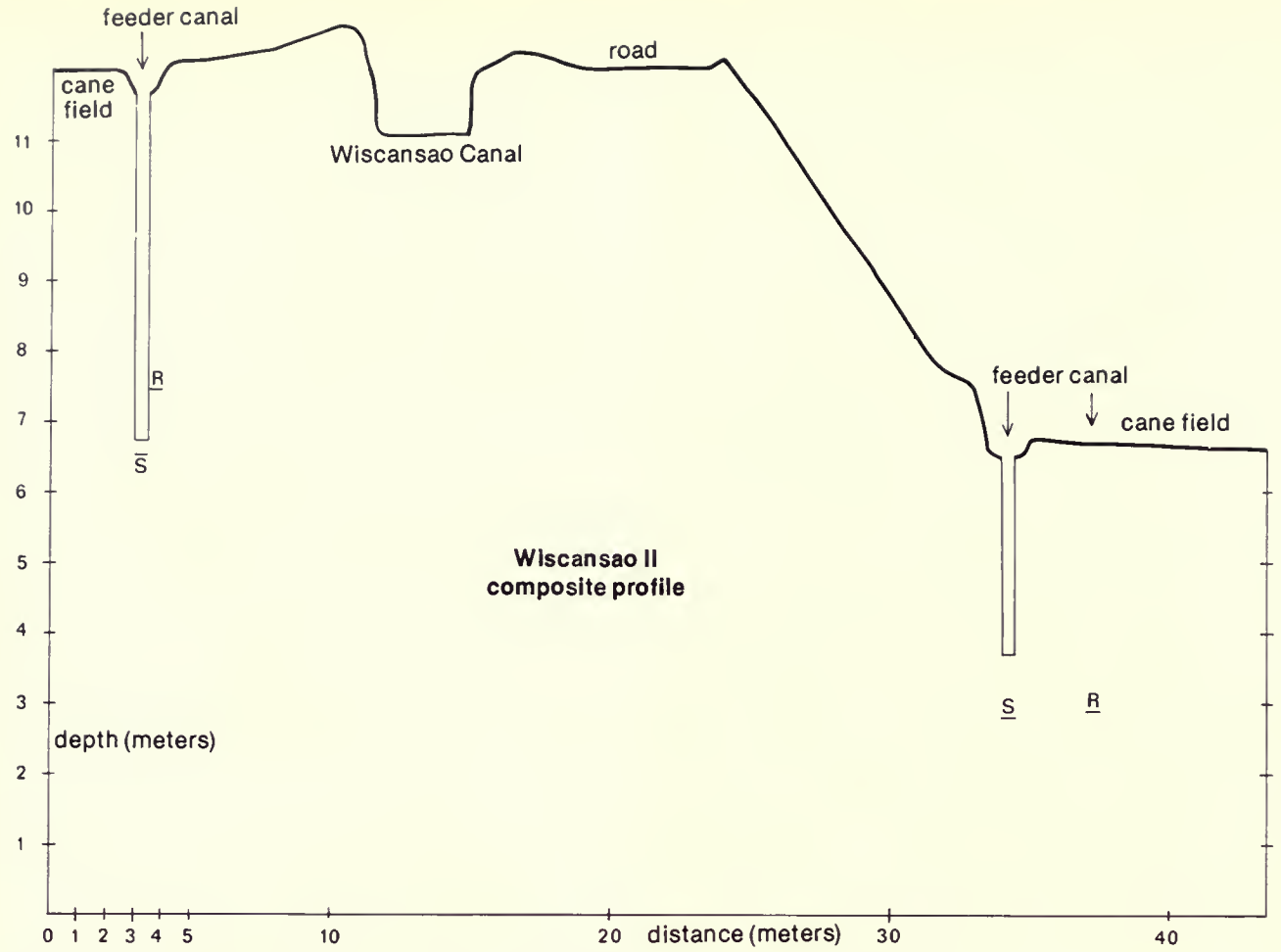
that, at times, they were built on entirely natural terraces, or were themselves wholly responsible for the artificial development of a terrace through the process of gradual silt deposition. By extending our instrument survey to other canals, we will eventually be able to map the relationship between the original natural landscape and irrigation features throughout the valley.

Another test that we ran was designed to estimate the rate at which soil build-up occurred. The Wiscansao canal passes through a very old mound group called Caballo Muerto. Earlier excavations by PRA codirector Thomas Pozorski had located the base of one of these mounds more than four meters below the present ground surface. Nearby is a small mound of the Chimu period. We were able to locate the foundation of this mound at a depth of only one meter. Tests between the two mounds showed that the Chimu mound was built on soils deposited since Caballo Muerto times. Assuming that these three meters of soil had been deposited at a uniform rate over the 2,200 years between *ca.* 1000 BC and *ca.* 1200 AD, the average yearly deposit comes to about 1.3 mm (about $\frac{1}{20}$ inch). A similar rate can be calculated using the one meter of soil build-up that has occurred in the almost 800-year span since the construction of the Chimu structure.

What did we learn from our work? Perhaps the most important point is that irrigation agriculture, even in the nonmechanized world of pre-Columbian Peru, has a tremendous impact on the environment. The Peruvian coast is a very dry desert, so there is normally little or no soil formation. By contrast, soil built up at the rate of about an inch every 15 to

*The modern Wiscansao Canal runs along the top of this terrace. Three thousand years ago, the ground surface was over 5 meters lower.*

Robert Feldman




*Cross-section illustrating results of seismic, resistivity, and augering tests. (Arrows mark test sites, R=resistivity depth, S=seismic depth.)*

20 years in irrigated areas. The build-up was twice as great above a canal as below. This difference indicates that while some of the new soil was dropped from winds slowed by the crops, much came as silt in irrigation water from higher canals and was trapped by the raised banks of the lower canal.

Silt is not the only thing irrigation can leave behind; it can also deposit salt, ruining the land rather than renewing it. If the irrigation system is improperly designed and lacks either sufficient flow or adequate drainage to "flush" the soil clean, naturally occurring salts dissolved in the water can accumulate and precipitate out. Salinization, as this process is called, occurred in some areas of prehistoric Peru when pressure to increase farmlands led to the use of poorly drained areas; these were soon transformed into salt pans and had to be abandoned. Salinization occurs on the lower Colorado River in Arizona and in northern Mexico where too much water is being used upstream, so there is not enough left to flush the fields of the lower basin clean of salts.

Where the water comes from is often as important as where it goes. In coastal Peru canals were fed by rivers dropping precipitously from the Andes, so water that would otherwise have raced into the Pacific was diverted onto—and into—the dry land. In the Moche Valley this not only made large-scale farming possible, it also created an underground reservoir of potable water. Residents of Chan Chan, the capital of the Chimu Empire, tapped this ground water by digging huge walk-in wells and sunken gardens. Their dual use of irrigation water shows great forethought on the part of the Chimu engineers.

The natural path of water used for irrigation is something that should be considered in designing modern water projects. We can see the unfortunate results of ignoring this natural water regime in areas where irrigation systems fed by wells are lowering the water table almost as fast as deeper and deeper wells can be drilled, or in areas where the underground water supply is gradually disappearing because of unrestricted—and unwise—diversion of the great rivers that once fed aquifers (water-bearing rock, sand, or gravel).

The PRA will continue to chart the effects of irrigation on the desert landscape during the pre-Columbian past. The initial results of our research serve as a cautionary tale. In the exceptionally arid environment of coastal Peru, the architects of the ancient waterworks were supremely sensitive to the problem of utilizing their scarce and precious water resources most efficiently. Today, in the face of ever-encroaching deserts throughout the world, can we afford to be any less sensitive to this same problem? □

OUR ENVIRONMENT (*from p. 3)*

**Hawaii**—The Hawaiian wild broadbean, *Vicia menziesii,* is a pea family member of Hawaii, a relative of the broadbean, and the only one of its kind native in Hawaii. Seed probably reached the islands from the Americas, where all its relatives are native. Six mature plants are known to exist. Introduced animals, including wild sheep, goats, and pigs, have destroyed much of the natural vegetation, including this Hawaiian wild broadbean.

Texas—Texas wildrice, *Zizania texana,* grows year-round in the warm spring-fed waters of the San Marcos River in Texas and is one of three species of wildrice found in North America. A fourth species in the genus, its only other relative, is native to East Asia. The Texas wildrice could prove useful for improving cultivated wildrice and in providing knowledge about disease resistance. This species was once very common in a portion of the San Marcos River. However, much of its natural habitat has been destroyed, and in recent years it has rarely produced seeds.

### Gray Wolf Reclassified

The gray wolf (*Canis lupis*) has been reclassified from endangered to threatened in Minnesota, culminating a heated controversy over the animal's status in the only one of the lower 48 states that still supports a viable population of the species.

According to the U.S. Fish and Wildlife Service, the reclassification reflects the increase in numbers, extension of the animal's range in northern Minnesota, and the fact that it is no longer in danger of extinction in that part of its range. Under the 1973 Endangered Species Act, a species is listed as "endangered" if it is in danger of extinction throughout all or a significant portion of its range; "threatened" means that a species is likely to become endangered within the foreseeable future throughout all or a portion of its range.

The gray wolf, also commonly known in the North as the timber wolf, has been a source of continuing controversy since it was listed as endangered in 1967. The Minnesota Department of Natural Resources has been pushing for complete removal of the timber wolf from the federal list because it contends that wolves have reached record numbers, and they are preying on domestic livestock. The wolf population in Minnesota in 1976 was estimated at about 1,200, according to FWS. Prior to protection, an annual kill of 20 to 30 percent was occurring in Minnesota, according to the Eastern Timber Wolf Recovery Team, but the statewide wolf population did not noticeably decline. Recognized wolf expert David Mech, a member of the recovery team, has noted that the breeding potential of wolf populations with adequate prey and without mortality could at least double each year.

Besides preying on livestock, the meat-eating wolves also kill other large animals such as moose and deer. As human settlement usurped wilderness, a great deal of the prey's habitat went by the wayside; this human presence also caused the current problem with domestic livestock.

The latest action changing the status of the timber wolf was largely an outgrowth of recommendations of the recovery team issued in 1976. The team, by a vote of 7 to 1, determined that the wolf should remain on the endangered species list, but be reclassified as threatened *in Minnesota only.* (In 1974 the state of Minnesota petitioned FWS to exclude the wolf from the endangered list, but FWS took no action, pending the recovery team's recommendations.)

FWS also followed the recovery team's advice to divide the state into five wolf management zones. About 9,825 square miles in the northern part of the state, Zones 1, 2 and 3, were designated as critical habitat for the wolf. It will be completely protected in its prime range, some 4,462 square miles of Zone 1, mainly the Boundary Waters Canoe Area and Superior National Forest. In the other zones, wolves may be taken if they commit significant attacks on lawfully present domestic animals. However, only authorized federal and state employees can take any wolves found killing livestock. Any such kills are expected to primarily occur in the more populous and developed Zone 4, FWS said. Though the government disagreed, the recovery team advocated public hunting and trapping of wolves in Zone 4, "because the population needed thinning," Mech said.

In the state, almost all the habitat where wild prey are located is already occupied by wolves. An overflow of wolves into more settled areas could only "foster hatred for the wolf, and we don't want that," Mech added.

The fifth zone, the remainder of the state, is currently devoid of wolves.

FWS ruled against Minnesota's petition for complete declassification because population density alone will not ensure the long-term welfare of the wolf, it said. Although the wolf may have reached the habitat's carrying capacity in some areas and expanded into others, at one time it occupied the entire state. The areas in which it now lives represent a comparatively small portion of the wolf's original range, the service noted.

Public comment received on the rulemaking favored retention of the endangered classification. Many groups thought the Minnesota wolf population should not be separated from the rest of the wolves in the lower United States, but rather it should be considered a tiny and endangered remnant of a formerly wide-ranging species. FWS disagreed and made its decision, insisting that it was based on biological, not social or political reasons.

Aside from any legal protection extended to the wolf, one crucial point remains, made clear by the recovery team: "Ultimately the welfare of the wolf depends on the availability of large tracts of wild, inaccessible land with adequate prey numbers. Current trends toward mining, commercialization, and other development in Minnesota portend a decrease in suitable wolf range."

### Swamps Burn Too

When in the grips of a severe, prolonged drought, swamps are as prone to wildfires as are forest lands. Swamp fires are an unusual phenomenon because they are often subterranean, inching through the deep layers of peat that cover a swamp's

floor. Only when the surface peat is smoldering, or when groves of trees explode into flaming torches or topple from having their ground support of peat charred, are firefighters able to pinpoint and smother the flames. Meanwhile they must stand by helplessly, unsure of where to direct their efforts, awaiting rain to extinguish the deep-burning fires.

Such are the possibilities facing the Okefenokee Swamp, a national wildlife refuge in southern Georgia, now reaching the end of what appears to be a 20 to 30 year drought and fire cycle. Exceptionally scanty rain is bringing the swamp to the drought conditions that preceded devastating wildfires in the 1840s, 1880s, 1930, and mid-1950s. "The water is down two feet or more, the lowest it's been since '54 and '55," says Okefenokee swamp guide Clay Purvis, "and that's when almost the whole swamp burned, burned for months. Everyone says it will happen again."

Peat is the compacted decaying layers of plant material that blanket the swamp floor and continually accumulate, building higher towards the water surface as plants die and settle to the bottom. A flammable material used for fuel in some European countries, peat covers virtually the entire sandy bottom of the Okefenokee, in some spots to a depth of 20 feet.

As a drought increases in severity and the waters recede, the areas of exposed dried peat expand and deepen. Fire, usually ignited by lightning, can burn and creep along ten feet underground, gouging out large pockets and holes as it progresses. Peat often smolders for weeks, even when it rains. Conflagrations can begin anew if dry weather then returns, scorching untouched areas or reburning others. Bald cypresses, the Okefenokee's dominant trees, usually survive the slow ground fires, unless high winds force the flames to "crown" into the treetops or if flames severely char the peat-bound roots.

Regardless of their devastating appearances, past fires helped to create and maintain the Okefenokee's "swampscapes." The "prairies," or marshlands, rely on fire to remove compacted, built-up peat that provides a firm surface for invading woody plants. If the swamp went too long without burning, the prairies could become densely forested with bald cypresses and black gums. Bays and boat trails would be filled in, and the entire swamp would slowly change to woodlands. The Okefenokee's prairies, as with prairies in other habitats, are considered by many to be a fire climax, preserved by burnings extending back as far as the Pleistocene era, when the swamp's deep-lying charcoal deposits were probably laid down.

Corings taken throughout the swamp indicate that fires often burned as much as six feet into the peat beds in the last 130 years. Fires in 1932 and 1954-55 burned the beds along the swamp's western edge so harshly that when the area refilled with water, the deep peat burns eroded and the flow of the Suwannee River increased to the point where it threatened to drain the swamp. Peat and lush aquatic vegetation normally act as a sponge, soaking up rain in the wet season and slowly releasing it under the summer sun. However, this life-giving capability is lost for a period once the peat is burned.

Nearly four-fifths of the Okefenokee's 680 square miles and some 142,000 acres of surrounding uplands flamed in the 1954 and 1955 fires. With fear of fire running rampant, the federal government undertook a damming project to keep water levels high enough to prevent extended fires in the future. A large sill was built from dredged mud near where the Suwannee River runs out of the swamp's southwestern edge. The sill slows water drainage since the Okefenokee's rain-supplied water flow in a generally southwesterly direction. The sill is crucial in this respect, for the swamp has little groundwater on which to rely during dry spells.

The results of building the sill are mixed; if the Okefenokee's water levels are low now, they would probably be disastrously low without the sill. Yet the decision to stamp out fire in the Okefenokee was equally weighty. Abundant water, coupled with fire prevention tactics, might in the long run threaten prairie maintenance. It will allow peat to build up sufficiently and provide firmer surfaces capable of supporting shrubs and trees. Natural landscape changes promoted by fire are impeded without it; for example, peat holes carved by deep-burning fires ordinarily become new gator holes, lakes, and even prairies when the seasonal flood waters return.

So far, wildlife in Okefenokee are faring quite well. Receding waters are forcing amphibians, fish, and water birds into the remaining lakes and large "gator pools" cleared by breeding and feeding alligators, but food is still plentiful. Should drought conditions worsen, however, aquatic birds are apt to leave for wetter areas, amphibians and small reptiles might hole up and wait out the drought, while small animals like raccoons and opossums could migrate out of the swamp.

The alligator population, up to 22,000 in 1975 from 11,000 in 1970, is having an easy time in feeding, as other wildlife concentrate around the remaining pools and lakes. The alligators too are beginning to congregate more than usual, since in normal times they remain dispersed throughout the Okefenokee. Males normally retain their own territories, and forced congregation is causing them to fight more, according to Purvis. Swamp officials agree that most alligators will survive a fire by running from it and submerging into the deeper pools and holes.

The Okefenokee's eastern prairies are a major year-round habitat for the endangered Florida sandhill crane, whose existence would be threatened if fire were kept from the prairies so long that woody vegetation could establish itself. Some fear that alterations of the swamp's natural cycles could point this magnificent bird down the same path as the highly endangered ivory-billed woodpecker, one of whose last refuges was the Okefenokee Swamp.—Julie Abramson, *Conservation News*

### Back to the Road with Old Tires

Each year an estimated 200 million tires are discarded in the United States, creating serious disposal problems. In an effort to recycle rubber tires, the Tennessee Valley Authority (TVA) and the Federal Highway Administration (FHA) recently concluded a 2½-year test project using discarded rubber tires as part of a paving mixture for roads to remedy highway cracking, a common maintenance problem. The mixture of reclaimed rubber, asphalt, and limestone chips was applied to a section of road in TVA's outdoor center in Kentucky, Land Between the Lakes. A second section was paved with conventional asphalt. Test results showed the asphalt pavement had cracked, while the pavement covered with the new seal-coat did not. Since costs of processing and spreading the seal-coat are estimated to be 45 percent higher than the regular asphalt mix, the FHA recommends the rubber tire mixture be used only to resurface roads suffering from "fatigue" or other extensive cracking.

# A FESTIVAL OF ANTHROPOLOGY ON FILM

Cosponsored by Field Museum of Natural History and the University of Illinois at Chicago Circle.

**Saturday, August 12 and Sunday, August 13, 1978**
**Since the invention of photography, fragments of foreign worlds have been captured and preserved on film. For Field Museum's first anthropology film festival, an overview of man and anthropology will be presented for a weekend of entertainment or enlightenment. While the weekend has been organized into conceptual units, the films stand on their own. The viewer may follow themes throughout or move from film to film.**

## SATURDAY, AUGUST 12, 1978
### HISTORICAL PERSPECTIVES

The grand expeditions of the nineteenth century left a legacy not only of knowledge and museum collections, but a romance of exploration and exotica. Photographs made for scientific documentation, such as magic lantern slides, were taken out of context and played to mass appeal. At the same time, some commercial films capitalizing on the interest in the strange and unknown were carefully documented reconstructions of reality in a fictional mode. Robert Flaherty, who's work inspired the British documentary movement, radically changed filmmaking with his human compassion, visual sense, and informative detail.

**EXPLORATION AND EXOTICA**
James Simpson Theatre
10:00 a.m.

Special screening of nineteenth century magic lantern slides, Field Museum of Natural History collection.

10:15 a.m.

*Land of the Zuni and Community Work* (1923) 17 m.
F. W. Hodge and Owen Cattell

*Moana* (1926) 85 m.
Robert Flaherty

12 Noon

"Anthropology on Film: A Historical View" (Lecture)
Emilie de Brigard, Film Research

*Alluring Bali* (1937) 11 m.
Burton Holmes

*Song of Ceylon* (1934) 45 m.
John Grierson and Basil Wright

**COMING OF AGE OF ETHNOGRAPHIC FILM**

The decade of the fifties witnessed the real maturity of ethnographic film, setting the stage for the vast expansion of the sixties and seventies. Yet there was still little consensus. Each of our four "moments" offers a different approach to an anthropologically informed cinema; each related in a different way to written materials.

A. Montgomery Ward Lecture Hall
2:15 p.m.

*Childhood Rivalry in Bali and New Guinea* (1952) 17 m.
Gregory Bateson and Margaret Mead

Encyclopaedia Cinematographica
*Halloween Customs, Central Pennsylvania* (1966) 13 m.
Leslie Greenhill

*The Hunters* (1957) 73 m.
John Marshall

*Les Maitres Fous* (1955) 30 m.
Jean Rouch

**THE WORK OF EDWARD S. CURTIS**

Though now becoming widely known for his stunning still photographs of the North American Indian, Edward S. Curtis was also an important early maker of "anthropological" film. His fictionalized "documentary romance," *In the Land of the Headhunters,* preceded Flaherty's *Nanook* by almost a decade, and maintained a high degree of ethnographic accuracy. Two versions of this film are included to make viewers aware of the kind of editing and rearrangement a film can go through over the years.

A. Montgomery Ward Lecture Hall

*The Shadow Catcher* (1975) 88 m.
T. C. McLuhan

*In the Land of the Headhunters* (Vigil of Motana) (1914) 38 m.
E. S. Curtis

# SATURDAY & SUNDAY, AUGUST 12-13, 1978

*Land of the War Canoes* (1974) 47 m.
E. S. Curtis/Bill Holm and George Quimby

## FILMMAKER'S RETROSPECTIVE

The retrospective will be a personal statement by Asen Balikci on his extensive project of filmed reconstructions of Netsilik Eskimo life. He will premiere his just-completed work on Afghanistan and discuss his plans for future work.
In addition to the screenings, the program will include comments from the filmmaker and discussion with the audience.

James Simpson Theatre
2:15 p.m.

"Filmmaker's Retrospective" (Lecture)
Dr. Asen Balikci, Professor
Department of Anthropology, University of Montreal

**WOMEN AND MEN—INDIVIDUALS AND INTERACTIONS**
Lecture Hall II
11:00 a.m.

*Shunka's Story* (1969) 24 m.
Stephanie Krebs

*Masai Women* 55 m.
Chris Curling and Melissa Llewelyn-Davis

*Women of the Toubou* (1974) 25 m.
Anne Balfour-Fraser

*Kypseli: Women and Men Apart—A Divided Reality* (1976) 40 m.
Paul Aratow, Richard Cowan, and Susannah Hofmann

*Rivers of Sand* (1974) 83 m.
Robert Gardner

*Under the Men's Tree* (1974) 15 m.
David MacDougall

*Coniston Muster* (1976) 29 m.
Australian Institute of Aboriginal Studies

*A Group of Women* (1969) 5 m.
John Marshall

*Men Bathing* (1972) 14 m.
John Marshall

*The Yanomamo Myth of Naro As Told By Kaobawa* 17 m.
Timothy Asch and Napoleon Chagnon

*A Man and His Wife Weave a Hammock* 12 m.
Timothy Asch and Napoleon Chagnon

*The Axe Fight* (1971) 30 m.
Timothy Asch and Napoleon Chagnon

**MUSIC AND DANCE**
Classroom A
1:00 p.m.

*Atumpan: Talking Drums of Ghana* (1963) 14 m.
Mantle Hood

*Mbira: The Technique of the Mbira dza Vadzimu* (1978) 19 m.
Andrew Tracey, Gei Zantzinger, and Les Blank

*Bitter Melons* (1968) 30 m.
John Marshall

*Gelede* (1970) 24 m.
Peggy Harper and Francis Speed

*Hot Pepper* (1972) 54 m.
Les Blank

*Trance and Dance in Bali* (1951) 20 m.
Gregory Bateson and Margaret Mead

*Traditional Music and Dance of Sikkim,* Part 1 (1972) 30 m.
Frederic Lieberman and Michael Moore

## SATURDAY EVENING PROGRAM
## IMAGES OF CHICAGO

James Simpson Theatre
8:00 p.m.

*Anthony J. Paterno* (1977) 58 m.
Herb di Gioia and Gerald Temaner

*Mi Raza—Portrait of a Family* (1976) 28 m.
Susan Stechnij and Paul Hockings

*The Popovich Brothers of South Chicago* (1977) 60 m.
Jill Godmilow

# A FESTIVAL OF ANTHROPOLOGY ON FILM

## SUNDAY, AUGUST 13

### GENRES

These films are representative examples of the present practice of ethnographic film as documentary or nonfiction. As such they revolve around "observation," or the recording of life "as it really is." Each is about exotic worlds of meaning and behavior, and our access to them—a central anthropological concern. But more importantly, they represent the implications of the various modes by which we may present our understanding.

**PART I**
James Simpson Theatre
10:00 a.m.

"Genres" (Lecture)
Dr. Paul Hockings, Associate Professor
Department of Anthropology, University of Illinois at Chicago Circle

Cinema Verite
*Chronicle of a Summer* (1961) 90 m.
Jean Rouch and Edgar Morin

Observational Cinema
*To Life with Herds* (1973) 68 m.
David MacDougall

Sequence Films
*A Father Washes His Children* (1971) 15 m.
Timothy Asch and Napoleon Chagnon

*Weeding the Garden* (1971) 14 m.
Timothy Asch and Napoleon Chagnon

**PART II**
A. Montgomery Ward Hall
1:00 p.m.

Research Film—Choreometrics
*Dance and Human History* (1976) 40 m.
Alan Lomax

Film Form: Derived from Research
*The Path* (1972) 34 m.
Donald Rundstrom, Ronald Rundstrom, and Clinton Bergum

Reconstruction
*Moontrap* (Pour la Suite du Monde) (1963) 84 m.
Pierre Perrault, Michel Brault, and Marcel Carriere

Interpretive Film
*The Nuer* (1971) 75 m.
Hilary Harris, George Briedenbach, and Robert Gardner

### REFLEXIVITY

Film has always seemed the most "realistic" and "objective" of mediums, yet by its dependence on camera angles and editing (during shooting and in the lab), it is actually one of the most subjective. This realization, recent in both anthropology and photography, will be explored in this discussion. Of particular interest is the "reflexive" nature of the encounter which produces the film: the way the filmmaker influences the actors by his presence, as well as the effect native action has on the filmmaker. These become one when the filmmaker films himself, as some of the Navajo have done. Hubert Smith will show and discuss work in progress from a reflexive film project dealing with the contemporary Yucatec Mayan Indians.

ETHNOGRAPHIC SCIENCE FICTION
James Simpson Theatre
1:00 p.m.

*Jaguar* (1953-1967) 93 m.
Jean Rouch

2:30 p.m.

"Reflexivity in Anthropological Film" (Seminar)
Hubert Smith, Project Director, Yucatec Maya Film Project

THE FILMMAKER AS ACTOR

The first two films depict the anthropologist at work, work which sometimes finds its way into a film. As more than just records of field work, these films can be an exploration of the constantly shifting influences of the filmer and the filmed.

A. Montgomery Ward Hall
10:00 a.m.

*A Man Called "Bee": Studying the Yanomamo* (1974) 40 m.
Timothy Asch and Napoleon Chagnon

# SATURDAY & SUNDAY, AUGUST 12-13, 1978

*Gurkha Country* (1967) 19 m.
John and Patricia Hitchcock

*Regrouping* (1976) 75 m.
Lizzie Borden

HUMAN ECOLOGY
Lecture Hall 11
10:00 a.m.

*Land Without Bread* (1932) 31 m.
Luis Bunuel

*The Village* (1969) 70 m.
Paul Hockings and Mark McCarty

*Beautiful Tree—Chishkale* (1975) 20 m.
American Indian Film Series

*Baobab* (1973) 51 m.
Joan and Alan Root

*Baobab Play* 8 m.
John Marshall

*The Turtle People* (1973) 26 m.
Brian Weiss and James Ward

*Slash and Burn Agriculture* (1975) 17 m.
Brian Weiss and James Ward

ARTS AND CRAFTS
Lecture Hall 11
2:00 p.m.

*In Praise of Hands* (1974) 28 m.
Donald Winkler

*Wooden Box: Made by Steaming and Bending* (1962) 33 m.
American Indian Film Series

*Sinew Backed Bow and Its Arrows* (1961) 24 m.
American Indian Film Series

*Abuja Pottery* (1973) 22 m.
Alister Hallum

*Potters at Work* (1977) 29 m.
Marty Gross

*Le Tonnelier* (The Cooper) (1942) 28 m.
Georges Rouquier

HUMOR, IRONY, AND PARODY
Classroom A
1:00 p.m.

*Joking No Laughing Matter* (1977) 17 m.
Michael Siporin

*Trobriand Cricket: An Ingenious Response to Colonialism* (1976) 50 m.
Jerry Leach

*Spirit of Ethnography* (1974) 18 m.
O. Michael Watson

*The Plaint of Steve Kreines, as Recorded by His Younger Brother Jeff* (1974) 47 m.
Jeff Kreines

*The Owl Who Married a Goose* (1974) 8 m.
Caroline Leaf

*A Joking Relationship* (1969) 12 m.
John Marshall

*Necrology* (1970) 12 m.
Standish Lawder

Festival Organizers: Ira S. Jacknis, Jane E. Swanson
Coordinators: Carolyn P. Blackmon, James Hunter
Consultants: Emilie de Brigard, Paul Hockings

Special thanks to:

Lizzie Borden, Filmmaker, New York, NY; Balkan Arts Center, New York, NY; Bosustow Productions, Santa Monica, CA; Documentary Educational Resources, Somerville, MA; Film Images, Oak Park, IL; Granada Television International, New York, NY; International Film Bureau, Chicago, IL; Museum of Modern Art, New York, NY; Museum of the American Indian—Heye Foundation, New York, NY; National Film Board of Canada, New York, NY; New Yorker Films, New York, NY; Pennsylvania State University, University Park, PA; Phoenix Films, New York, NY; Pyramid Films, Santa Monica, CA; University of California Extension Media Center, Berkeley, CA; University of Illinois at Chicago Circle, Chicago, IL; and University of Washington Press, Seattle, WA.

**A Festival of Anthropology on Film August 12 and 13th, 1978**
**Field Museum of Natural History**

Last Name First Name

Street

City State Zip Code

Phone: Daytime Evening

☐ Member ☐ Nonmember

Both Days: $5.00 Member $6.00 Nonmember
One Day: $3.50 Saturday Night Only: $1.50

Number of People _____ at $_____

Amount of check enclosed $_____

Please use West Entrance for free admission to the Museum.
Confirmation will be mailed* upon receipt of check.
Please include self-addressed stamped envelope. Mail to

FILM FESTIVAL, FIELD MUSEUM.

*If coupon and check are received one week or less before the program, reservations will be held in your name at the West Entrance.

Field Museum of Natural History
Roosevelt Road at Lake Shore Drive
Chicago, IL 60605

# NATURAL HISTORY QUIZ

*The following 17 questions, some bordering on the fantastic, were compiled by Ken Grabowski of the Field Museum Library staff and distributed to recent Members' Night visitors. No one, he reports, made a perfect score.*

1. How long does it take to hard-boil an ostrich egg?
   (a) 40 minutes (c) 26 minutes
   (b) 18 minutes (d) 12 minutes

2. How much money is the human body worth?
   (a) 97 cents (c) $6,000,000
   (b) $5.60 (d) it depends

3. What is the highest temperature which can be reached in our universe?
   (a) 1,000,000°K (c) 600,000,000°K
   (b) 10,000,000°K (d) 6,000,000,000°K

4. What is the greatest recorded change in temperature in the United States for a 24-hour period?
   (a) 80°F (c) 100°F
   (b) 90°F (d) 110°F

5. What is the second tallest mountain in the world?
   (a) K2 (c) Lhotse I
   (b) Kangchenjunga (d) Makalu I

6. What is the second deepest ocean trench in the world?
   (a) Tonga Trench (c) Philippine Trench
   (b) Kuril Trench (d) Izu Trench

7. What is the easternmost state in the fifty United States?
   (a) Maine (c) Hawaii
   (b) Alaska (d) Florida

8. What is the westernmost state in the fifty United States?
   (a) Washington (c) Hawaii
   (b) Alaska (d) California

9. In terms of heartbeats per lifetime what mammal lives the longest?
   (a) tree shrew (c) human being
   (b) Asiatic elephant (d) Bengal tiger

10. From what tree do we get two spices?
    (a) sweet bay tree (c) nutmeg tree
    (b) allspice tree (d) tonka bean tree

11. What is the only bird with two toes?
    (a) ostrich (c) hummingbird
    (b) chicken (d) woodpecker

12. What plant has the largest seed?
    (a) coconut (c) watermelon
    (b) coco de mer (d) pumpkin

*Continued on p. 22*

# A Festival of Anthropology on Film

By Ira Jacknis and Jane Swanson

Though not usually thought of together, the union of anthropology and film offers us an almost unlimited panoply of affective and informative images. This union will be celebrated August 12 and 13, when Field Museum screens about 80 works covering over half a century of anthropological filmmaking. Each film is a landmark in the development of the genre or is notable for its particular aesthetic or educational merits. Our purpose here is to provide an introduction to this special world of filmmaking that has, until now, been largely the province of the specialist.

The term "anthropology on film" may be applied to any filmic medium, including still photographs, employed in the realm of anthropology. "Ethnographic film," a category within that of anthropology on film, has been described by David MacDougall, a noted ethnographic filmmaker, as "any film which seeks to reveal one society to another. It may be concerned with the physical life of a people or with the nature of their social experience." MacDougall points out that many ethnographic films, such as the classic *Nanook of the North* (1922), have been made by nonanthropologists. It could be further noted that many films which are used for their anthropological content were not made with any scientific purpose in mind. Films created by persons of a particular culture may also be the subject of cultural study by anthropologists, or film footage may be examined simply for the raw cultural data embodied in it.

Among the first subjects of the still camera were exotic peoples in far-away lands. In the decades following the Civil War, still photographers such as William Henry Jackson, Jack Hillers, and Will Soule captured portraits and scenes of American Indian tribes on the verge of vanishing. The movie camera was used near the turn of the century by anthropological expeditions to New Guinea and Australia. But it took longer than one might suppose for the new medium of film to catch up with the demands of an increasingly sophisticated anthropology. Only partly did the reason for this lie in the technology of films, cameras, and sound-recording equipment. Anthropological film was caught between the popular demand for exoticism and fiction and the scientist's awkwardness and hesitancy in utilizing the new medium. Nonetheless,

*Pioneer photographer William H. Jackson*

Historical Pictures Service, Chicago

*Scene from Robert Flaherty's classic* Nanook *(1922)*

The Bettman Archive Inc.

some of the early films are now considered classics and we return to them again and again for viewing pleasure as well as for the cultural information they contain.

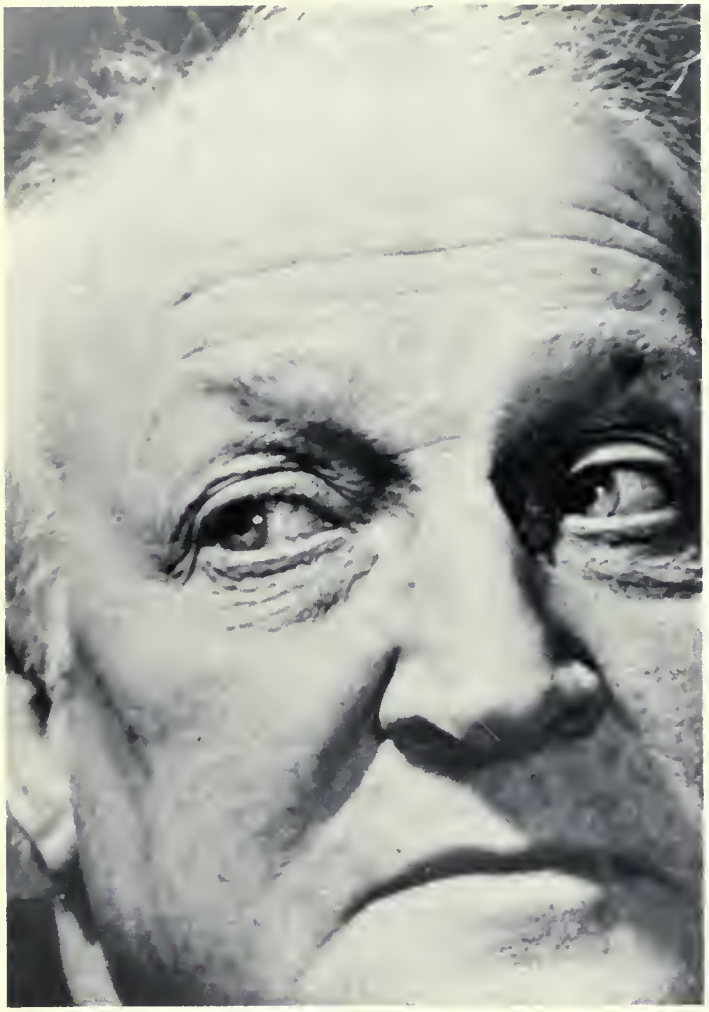
Many of these early photographs were made into glass slides for the magic lantern projector. These, like motion picture films which followed, were shown mostly to general audiences. Even then—as in the other graphic arts and literature—realism and romanticism were competing with one another. Some of the earliest anthropological films were "documentary romances"—fiction films based on the traditional life of some exotic, often tropical people. An early and particularly fine example of this genre is Edward S. Curtis's *In The Land of the Headhunters* (1914). To be as accurate as possible, Curtis used the device of reconstruction, employing at the same time a melodramatic plot to reach a broader audience and thus realize some commercial success. By contrast, F. W. Hodge's museum-sponsored films about the Zuñi Indians (1923) were then unusual for their unpretentious, yet scrupulously accurate presentation of everyday scenes.

---

*Ira Jacknis and Jane Swanson are organizers of the Festival of Anthropology on Film.*

John Grierson, founder of the British documentary film movement, is given credit for coining the term "documentary" in 1926 to describe Robert Flaherty's second film, *Moana*. In Flaherty's earlier *Nanook* (1922), one of the finest and most widely known ethnographic films, the explorer-turned-filmmaker practically created the genre. *Nanook* was strong in human compassion and rich in cultural detail, setting a standard for years to come. Though not a trained anthropologist, Flaherty understood better than most how to investigate and describe foreign realms with the camera. The British films inspired by Flaherty's work were marked by their concern for problems of a developing world and social betterment, whether in the lyrically impressionistic *Song of Ceylon* (1934) by J. Grierson and B. Wright, or in the harsh realism of *Housing Problems* (1935), by E. Anstey and A. Elton.

During the twenties and thirties, movies of exploration and exotic fiction continued to fascinate the public. Besides scripted films of varying accuracy that featured native lifestyles, some films documented actual expeditions. *Grass* (1925), though set in the context of an adventure-seeking expedition, stands out as an impressive depiction of the great annual migration of Persian nomads over mountain and



*Robert Flaherty, creator of* Nanook

The Bettman Archive Inc.

river. During the Depression thirties, when social problems were being realistically dealt with in some British and American films, the escapist travelogue was also born. Burton Holmes, "father of the travelogue," gave the public what it wanted—local color, excitement, and quaintness, all embellished with his own live commentary. In ethnocentric works such as *Alluring Bali* (1937), Holmes presented the island paradise with little scientific discipline; the island was offered as a potential refuge for the harried Westerner just as the film provided momentary escape for the viewer.

Not until the fifties did ethnographic film come into its own as a mature film genre. A series of films of that decade reflect a sophisticated appreciation of anthropology, the science, on the part of their makers, and led directly to an explosion of ethnographic film in the next twenty years. However, little cumulative growth is to be seen in these early years, and each effort approaches the problem of filming native reality in a separate way.

The most important effort (and to this day still one of the most sophisticated) was the photographic work of Gregory Bateson and Margaret Mead in Bali during the late thirties. Their book of still photographs, *Balinese Character*, appeared in 1942, but their six films of life on Bali were not released for another ten years. Working within the field of culture-and-personality, they introduced schemes of relating film sequences that were both cross-cultural (*Child Rivalry in New Guinea and Bali*) and developmental (*Karba's First Years*).

The German style of ethnographic documentation fol-

*Burton Holmes, "father" of the travelogue*

The Bettman Archive Inc.

lowed a natural science model. In 1952 Gotthard Wolf established at Göttingen the *Encyclopaedia Cinematographica* as a consultable archive of world ethnic types, each arranged in taxonomic categories. The contents included footage of European and American folk life that seemed endangered. With scrupulous care, the Germans tried to depict natural sequences in native culture. Unfortunately, their efforts are sometimes less scrupulous in technical respects, and they often present no more than easily observed material culture or public ritual. There is little context, the implication being that Truth may be gained merely by pointing a camera at it.

Jean Rouch, of the Musée de l'homme in Paris, has created a number of important and influential variants of ethnographic film. *Les Maîtres Fous* ("The Mad Masters," 1955) is an emotionally powerful work intimately related to Rouch's published ethnography. In a series of works that included *Jaguar* (1953-67), *Chronicle of a Summer* (1960), *The Lion Hunters* (1965), and more recent films shot in West Africa, Rouch has advocated a self-aware, participatory cinema—a strong alternative to the German style, in which the filmmaker sought to efface himself and his camera.

American ethnographic film reached wide acceptance with two works produced by filmmakers affiliated with Harvard University: John Marshall's *The Hunters* (1957) and Robert Gardner's *Dead Birds* (1962). Both feature-length films are rendered in the Flaherty tradition, generally following a few individuals in narrative style as they encounter the environments of nature and man. Like Flaherty, Marshall and Gardner successfully combine many of the esthetic pleasures of fiction films with undirected action. *The Hunters* and *Dead Birds* were both filmed during expeditions in which scientific data gathered along with the footage went into the final edited film.

*The Hunters* and *Dead Birds* represent a turning point. Even before the release of the latter film, portable synchronous-sound equipment had revolutionized ethnographic film; and now federal funding, expansion of university programs, and a generally increased interest in both anthropology and film provided an ideal climate for its further growth and development.

Anthropologists discovered that film can be an invaluable tool in the field, an additional means of note-taking. Notes scribbled in the field may be partial and lack detail, but the filmed image can provide a more complete, visual record. Details intrusted to memory fade more quickly than the filmed image. Many anthropologists, then, included the movie camera as standard equipment while doing work in the field. It was hoped that film would be the most effective means for the translation of a foreign culture.

But on returning from the field, the filmmaker too often discovered that the footage was of little or no use. The technical quality was poor, or the footage didn't represent what was expected, or the cost of developing was prohibitive, or the filmmaker didn't know what to do with all the footage. Perhaps he would refer to the footage while preparing reports on the fieldwork, but the final result was the printed word.

The Bettman Archive Inc.

*Anthropologist Margaret Mead, together with Gregory Bateson, created landmark documentaries of life on Bali in the 1930s. Their* Trance and Dance in Bali *will be screened August 12 at 1 p.m.*

Few had the technical training in film necessary for developing footage into high quality, finished film.

In short, they discovered the hard way that the camera is not omniscient. Every aspect of filming and film editing involves subjective judgment. The filmmaker shapes the visual record according to his particular interests and solutions to problems he encounters in the field.

The work of the sixties and seventies is characterized by a collaboration of filmmaker and anthropologist in the field. In some cases, as with Jean Rouch, one person has served with distinction in both roles; but more often the strategies and techniques of anthropological film have sprung from the creative union of art with science.

One of the most productive filmmaker-anthropologist teams consists of Timothy Asch and Napoleon Chagnon, who worked with Indian tribes in South America. Anthropologist Chagnon, having spent several years studying the Yanomamo of northern Brazil, explained to Asch the significance of what was to be filmed. Asch, then, was able to avoid shooting material in an incomplete or disjointed manner. They chose to present the Yanomamo culture through a series of short films, usually composed of long continuous sequences rather than a series of shots edited together. For most of these "sequence films" there is little or no narration; dialog has been translated by voice-over or subtitles. When completed, the Asch-Chagnon series is to include some 50 films,

The Bettman Archive Inc.

*French cinematographer Jacques Truffaut (rt.) has been greatly influenced by techniques of anthropological filmmakers, notably Jean Rouch.*

each accompanied by a study guide with cultural background as well as shot-by-shot descriptions and explication of the action.

Asch and Chagnon have also pioneered in presentational techniques for longer features. In *The Feast* (1968) and *The Axe Fight* (1971) the film covers the action more than once. It first shows a series of stills with a voice-over explanation of background which will aid the viewer in recognizing salient points. Then the sequence follows as it actually occurred, uninterrupted; this segment is marked by the absence of a narrator's voice explaining the action—a device which, Asch and Chagnon contend, distracts the viewer.

The main concern of ethnographic film, as with most documentaries, is to present reality, revolving around the "observation" and recording of life as it "really is." One of the founders of *cinéma vérite* ("film truth"), Jean Rouch, argues that the camera and camera crew intrude on the subjects and influence the action. Rouch's *Chronicle of a Summer* (1961), done in collaboration with Edgar Morin, was one of the first films to make use of the so-called interview technique, in which the filmmaker's interaction with the subjects is an intrinsic part of the film's structure. The "new wave" in French cinema (which includes filmmakers Francois Truffaut, Jean-Luc Godard, and Louis Malle) is directly influenced by Rouch's work.

The term *cinéma vérité* is now applied to any documentary technique, particularly that which depends on lightweight, mobile camera equipment and small film crews. But a distinction should be made between Rouch's highly personal style and the so-called direct cinema movement, which shuns any involvement of the filmmaker in the action. Known as "observational cinema" in ethnographic film, direct cinema has been the dominant documentary style in the United States since the early 1960s. David MacDougall, a representative of this school of unobtrusive observation, recognizes the effect of the camera's presence on his subjects. In his film *To Live with Herds* (1973), however, he tries to minimize interaction, relying on gradual habituation to the camera to counter any disruptive effects.

In *Jaguar*, another of his experimental works, Jean

Rouch follows three African tribesmen in 1953 as they leave their village homes for the city. The narration was added ten years later as Rouch screened the film for the three men and recorded their comments on and reactions to the filmed images. *Jaguar* is also unique because it is partly fictional, based on narrative improvisation rather than on the anthropologist's direction. Rouch calls this style "ethnographic science fiction."

One of Rouch's cameramen, Michel Brault, applied both of these techniques—interaction with the native subjects and recognition of the interaction in the film itself—to another genre of ethnographic film, the reconstruction film. Like Flaherty's *Man of Aran* (1934), Brault's *The Moontrap* (1963) tries to capture a classic lifestyle which is no longer practiced. It concerns the catching of beluga whales by a community of French Canadians. Unlike most reconstruction films, *The Moontrap* is not presented as contemporary reality; rather it includes as part of the film the process by which the natives reconstruct the past.

Another distinguishing feature of the anthropological film is its purpose. Is the film the final result of research or merely the raw data for further research? New disciplines such as proxemics (cultural patterns of space use) and choreometrics (cultural patterns of body movement) utilize the intimate analysis of filmed behavior to develop hypotheses on the cultural use of space and the body. These are dealt with in Alan Lomax's film *Dance and Human History* (1976).

A totally different type of "research" film is represented by *The Path* (1972), which attempts to express through the form of the film as well as its content the highly elaborate Japanese tea ceremony. In this case the research preceded any filming; the film is the result of extensive research, not simply a presentation of raw data.

The forms of anthropological film that have been discussed here are only a representative few; and the August 12-13 film festival, too, can only sample this diversity. The approximately 80 films to be shown have been selected on the basis of historical sequence, relation to "observation" and research, or subject matter. This diversity, becoming richer with the passing years, is expressive of the healthy and exciting state of the art. Filmmakers continue to experiment with new forms, each with its particular purpose and strength, for there can be no single standard in a discipline caught between art and science, word and image, self and other. □

*Scene from* The Popovich Brothers of South Chicago, *a documentary to be screened August 12, at 8 p.m.*

## NATURAL HISTORY QUIZ *(con't from p. 15)*

13. Why does a hummingbird hum?

---

14. Which insect encounters the greatest number of g forces when jumping?
    (a) human flea (c) click beetle
    (b) desert locust (d) American grasshopper

15. Which is the only Great Lake to have a maximum depth of over 1,000 feet?
    (a) Superior (c) Ontario
    (b) Michigan (d) Huron

16. Which two planets in our solar system have rings around them?
    (a) Saturn and Mars (c) Saturn and Jupiter
    (b) Saturn and Uranus (d) Saturn and Neptune

17. Assuming ideal conditions, how long would it take to produce a generation of fruit flies which, when packed 1,000 flies per cubic inch, would form a ball extending from the earth to the sun? (Assume one male fruit fly and one female fruit fly to begin with, 25 generations a year, 100 eggs per female, half of the eggs hatching into males, the other half into females.)
    (a) 1 month (c) 10 years
    (b) 1 year (d) 20 years

### Answers

1. (a) 40 minutes. An ostrich egg is on exhibit at the Museum, in the southwest corner of Hall 21, Main Floor. An ostrich eggshell used as a water carrier is in the 75th Anniversary Exhibit in Hall 3, Main Floor, just east of the Bushman gorilla exhibit. (Source: *The Birds*, by Roger Tory Peterson, and the Editors of Life; 1963, p. 142.)

2. (d) It depends. In 1936, the raw chemical components (minus the water) of a 150 lb. human body were worth 97 cents. Inflation raised that figure in 1975 to $5.60. However, when these same chemical components remain intact in the body as insulin, DNA, etc., the value for a 150 lb. human body, as of 1976, becomes $5.37 million. And for a 168 lb. human body, $6 million. (Sources: *Science Digest*, February 1975, pp. 15-17; and 'The Six Million Dollar Man,' by Harold J. Morowitz. In *Hospital Practice*, March 1976, pp. 142, 145.)

3. (d) 6,000,000,000°K. This temperature is postulated to occur during the final stages in the formation of a supernova. (Source: 'Neutrino Emission Processes, Stellar Evolution and Supernovae,' by Hong-Yee Chiu. In *Annals of Physics*, July 1961, pp. 1-21, and December 1961, pp. 321-345.)

4. (c) 100°F. In Browning, Montana, on January 23-24, 1916, the temperature dropped from 44°F to -56°F. Brr! Appropriately, Rapid City, S.D., holds the record for the greatest temperature drop for a 15-minute period: 47°F. On January 10, 1911, the temperature went from 55°F at 7:00 a.m. to 8°F at 7:15 a.m. (Source: National Oceanic and Atmospheric Administration. In *The CBS News Almanac 1978*, p. 280.)

5. (a) K2 (also known as Godwin Austen, Chogori, or Dapsang), at 28,250 feet. K2 is part of the Karakorum Mountain Range between Kashmir and Sinkiang, and is 800 miles northwest of Mt. Everest (29,028 feet). (Source: National Geographic Society. As in #4 above, p. 269.)

6. Tonga Trench, at 35,702 feet. The Tonga Trench is in the South Pacific Ocean, east of the Tonga Islands and 3,600 miles southeast of Guam and the Mariana Trench (36,198 feet). (Source: Defense Mapping Agency Hydrographic Center. In *The World Almanac and Book of Facts 1978*, p. 439.)

7. (a) Maine, at West Quoddy Head, 66° 57' W, or (b) Alaska, at Semisopochnoi Island (179° 45' E), the Aleutians. The answer depends on the definition of "east" used. Traditionally the answer would, of course, be Maine. If though, the International Date Line is used in the definition of east-west, then Alaska, with its string of Aleutian Islands, is farthest "east." (Source: *Dunlop Illustrated Encyclopedia of Facts*, 1970, p. 355.)

8. (b) Alaska, at Cape Wrangell (172° 27' E), Attu Island, the Aleutians. The farthest "west" of the Hawaiian Islands is Kure Island at 178° 25' W. (Source: Same as for question 7.)

9. (c) A human being, with an average of some 2.6 billion heartbeats per lifetime (72 per minute, 37+ million per year, 2.6+ billion in 70 years). Normally no other mammal will attain much above 1 billion heartbeats per lifetime. (Source: 'The Slowly Moving Finger,' by Isaac Asimov. In his *Of Time and Space and Other Things*; Doubleday, 1965, pp. 211-222.)

10. (c) The nutmeg tree, *Myristica fragrans*. Its fruit contains nutmeg, as a seed, surrounded by mace (as an aril). Is there another plant with two spices? (Source: *Spices and Condiments*, by James B. McNair. Botany Leaflet 15, Field Museum of Natural History; 1930, p. 37.)

11. (a) The ostrich. (Source: Same as for question 1, p. 13.)

12. (b) The coco de mer tree, *Lodoicea seychellarum*, whose seed can weigh upwards of 40 lbs. A member of the palm family, the coco de mer is found only in the Seychelles Islands in the Indian Ocean. Field Museum has several coco de mer seeds in its botany collection. A common name for the seed is 'double coconut.' (Source: *The Guinness Book of World Records*, 1978 Edition, p. 124.)

13. Because it doesn't know the words. (Source: Morey Amsterdam on various occasions, including the *Dick Van Dyke Show*.)

14. (c) The click beetle, *Athous haemorrhoidalis*, enduring some 400 g's when taking-off and some 2,000 when landing. (Sources: 'The Prodigious Jump of the Click Beetle,' by Glyn Evans. In *New Scientist*, September 21, 1972, pp. 490-493; and *Animal Facts and Feats*, by Gerald L. Wood. Sterling, 1977 (revised edition), p. 184.)

15. (a) Superior, at 1,333 feet. (Source: National Ocean Survey, United States Commerce Department. In *The World Almanac and Book of Facts 1978*, p. 447.)

16. (b) Saturn and Uranus. The rings around Uranus were only discovered last year in what has been called the first major structural discovery in the solar system in fifty years. (Sources: *Science News*, March 19, 1977, p. 180, and April 16, 1977, p. 245; and *Nature*, May 26, 1977, pp. 328-332.)

17. (b) One year. The ball would be 96 million miles in diameter, 3 million miles or so more than the average distance of the earth from the sun. (Source: *An Introduction to the Study of Insects*, by Donald J. Borror, Dwight M. DeLong, and Charles A. Triplehorn. Holt, Rinehart and Winston, 1976 (4th edition), p. 3.)

# *July, August, and September at Field Museum*

*(July 15 through September 15)*

### Last Chance to See

**Locks from Iran: A Key to a Culture;** through July 30. A unique exhibit of 463 gold, bronze, and steel padlocks from Iran, surveying 16 centuries of lock-making. The exhibit is being circulated by the Smithsonian Institution Traveling Exhibition Service (SITES).

### Continuing Exhibits

**Yoruk: Nomadic Weaving Tradition of the Middle East;** through Aug. 22. The great art of the nomads—the making of fabrics from wool—comes to Field Museum in an important exhibit of approximately 110 weavings, mostly Persian and Afghanistanian carpets, saddlebags, and tent trappings. This exhibit attempts to preserve the weaving tradition of a rapidly vanishing culture. Hall 26.

**Field Museum Gamelan.** Field Museum's 19th-century Javanese gamelan, an ensemble of 24 fine bronze and wood musical instruments, has been completely restored for exhibition. It is the oldest and perhaps finest gamelan outside Indonesia. Hall K, ground floor.

**Pawnee Earth Lodge.** This exhibit, in Hall 5, is a traditionally made Pawnee earth lodge—the home and ceremonial center of Pawnee Indians as it existed in the mid-1800s. Daily programs provide the opportunity to learn about Pawnee culture. Public program hours: Monday through Friday, 1:15 p.m.; weekends, 11 a.m. and 1:15 p.m. Tickets may be obtained 15 minutes prior to the program at the north information booth. Programs limited to 30 people.

**The Place for Wonder.** This gallery provides a place to handle, sort, and compare artifacts and specimens. Weekdays, 1 p.m. to 3 p.m.; weekends, 10 a.m. to noon and 1 p.m. to 3 p.m. Ground floor, near elevator.

### New Programs

**First Field Museum Festival of Anthropology on Film.** Saturday and Sunday, August 12 and 13. Fragments of foreign worlds and anthropological studies captured on film. Includes lectures, units on "Historical Perspectives," "Ethnographic Film," "The Work of Edward S. Curtis," "Women and Men: Individuals and Interaction." For information about tickets and the program, see pp. 11-14.

**World Music Program for Children.** With Ira Kersh. For members' children. Series I begins Sept. 9. Introduces several cultures from around the world, including Tibetan, Thai, Indonesian, and Southwest Indian. For further information consult September-October *Calendar of Events.*

**Environmental Field Trips.** Begin Sept. 9. Consult *Kroc Field Trip Brochure* for further details.

**The Stationary Ark.** Illustrated lecture by Gerald Durrell, noted conservationist, zoologist, and author. Sept. 23 (repeat program Sept. 24 in case of sell-out), 2 p.m., James Simpson Theatre. $1.50 members, $3.00 nonmembers. For further details check September-October *Calendar of Events.*

### Continuing Programs

**To and Fro: Migration of North American Animals;** through August 31. This newest self-guided tour leads families and children through museum exhibits to illustrate the behavior of migrating animals. Free *Journey* pamphlets are available at the information booth, main floor. Bring pen or pencil.

**Friend or Foe? The Natural History Game;** recently opened. Field Museum's popular *Anthropology Game* has now been expanded to include botany, zoology, and geology. The object here is to determine which one of a pair of similar-appearing specimens is harmful and which is not. Some of the more dangerous playing elements include: a vampire bat, a headhunter's axe, a poisonous mineral, and a deadly mushroom. Ground floor; no closing date.

**On Your Own at Field Museum.** Self-guided tour booklets adult- and family-oriented, are available for 25c each at the entrance to the Museum Shop, main floor north.

**Weekend Discovery Programs.** Guided tours, demonstrations, and participatory activities. Every Saturday and Sunday, 10 a.m. to 3 p.m.

**Audio Information System.** Uniguide audio receivers and maps available for $1.25 per person, $3.75 for a family of up to five at the entrance to the Museum Shop, main floor north.

### July, August, and September Hours

**The Museum Opens** daily at 9 a.m. and closes (through September 4) at 6 p.m. every day except Friday. Beginning Sept. 5, the Museum will close at 5 p.m. On Fridays the museum remains open throughout the year until 9 p.m.

**The Museum Library** is open weekdays 9 a.m. to 4 p.m. Obtain a pass at reception desk, main floor. Closed July 4 and Sept. 4 (Labor Day).

**Museum telephone:** (312) 922-9410

September
1978

# Field Museum of Natural History Bulletin

**Field Museum of Natural History Bulletin**

September, 1978
Vol. 49, No. 8

*Editor/Designer:* **David M. Walsten**
*Production:* **Oscar Anderson**
*Calendar:* **Mary Cassai**
*Staff photographer:* **Ron Testa**

**Field Museum of Natural History**
Founded 1893

*President and Director:* **E. Leland Webber**

BOARD OF TRUSTEES

William G. Swartchild, Jr., *chairman*
Mrs. T. Stanton Armour
Goerge R. Baker
Robert O. Bass
Gordon Bent
Harry O. Bercher
Bowen Blair
Stanton R. Cook
O. C. Davis
William R. Dickinson, Jr.
Thomas E. Donnelley II
Marshall Field
Nicholas Galitzine
Paul W. Goodrich
Hugo J. Melvoin
William H. Mitchell
Charles F. Murphy, Jr.
James J. O'Connor
James H. Ransom
John S. Runnells
William L. Searle
Edward Byron Smith
Robert H. Strotz
John W. Sullivan
Mrs. Edward F. Swift
Edward R. Telling
Mrs. Theodore D. Tieken
E. Leland Webber
Julian B. Wilkins
Blaine J. Yarrington

LIFE TRUSTEES

William McCormick Blair
Joseph N. Field
Clifford C. Gregg
Samuel Insull, Jr.
William V. Kahler
Remick McDowell
James L. Palmer
John T. Pirie, Jr.
Donald Richards
John M. Simpson
J. Howard Wood

*Field Museum of Natural History Bulletin* is published monthly, except combined July/August issue, by Field Museum of Natural History, Roosevelt Road at Lake Shore Drive, Chicago, Il. 60605. Subscriptions: $6 a year; $3 a year for schools. Museum membership includes *Bulletin* subscription. Opinions expressed by authors are their own and do not necessarily reflect the policy of Field Museum. Unsolicited manuscripts are welcome. Postmaster: Please send form 3579 to Field Museum of Natural History, Roosevelt Road at Lake Shore Drive, Chicago Il. 60605. ISSN: 0015-0703.

CONTENTS

3 **Field Briefs**

5 **Egypt Tour for Members**

6 **Close Encounters of the Zeroth Kind**
by Edward C. Olsen, curator of mineralogy

14 **World Music Program for Members' Children**

15 **Mazon Creek Census**
by Gordon C. Baird, assistant curator of fossil invertebrates

22 **Mazon Creek: The First 120 Years**
by Matthew H. Nitecki, curator of fossil invertebrates

27 **September and October at Field Museum**
Calendar of coming events

COVER

*John Kolar, who took this month's cover photo, aims his 8×10 Deardorff view camera at a favorite subject: a native prairie, bog, or woodland in the Chicago area. A resident of North Riverside, a Chicago suburb, Kolar has trekked to far corners of the continent in quest of subject matter. Previous work of Kolar's to appear in the* Bulletin *has included photos of the Petrified Forest, in Arizona; Door County, Wisconsin; as well as locales in the immediate Chicago area.*

*The cover photo is of ground cover in an acid sand, black oak savannah, in Willow Slough State Game Preserve, in Northwestern Indiana. It was made on Ektachrome film, with a Rodenstock 360 mm Apo-Ronar lens; f16 at 1 sec.*

*Kolar's wife, Janet, who took the above photo, is also a highly talented nature photographer.*

# FIELD BRIEFS

### Staff Notes

**David M. Raup** became chairman of the Department of Geology on July 1; at the same time, he was appointed curator of geology. A native of Boston, Raup holds an S.B. from the University of Chicago, and received both his master's and his Ph.D. from Harvard University. Before coming to Field Museum he had been at the University of Rochester since 1965; from 1966 until 1978 he was professor of geology there. He also served as chairman of the Department of Geological Sciences and was director of the University of Rochester's Center for Evolution and Paleobiology. Prior to going to Rochester he was on the faculty of Johns Hopkins University (1957-65) and the California Institute of Technology (1956-57).

Raup served as president of the Palaeontological Society 1976-77. He was co-editor (with B. Kummel) of *Handbook of Paleontological Techniques* (1965) and co-author (with S. M. Stanley) of *Principles of Paleontology* (1971, 2nd ed. 1978). His major research interests have included the functional morphology and evolution of echinoids, biocrystallography and isotopic composition of the echinoderm skeleton, mathematical models of organic form, and the application of Markov models to problems of evolutionary paleobiology.

**Harold K. Voris,** who joined the Field Museum in 1973, has been promoted to associate curator of reptiles and amphibians. His primary field of research is the morphology, behavior, and natural history of sea snakes. Voris is also serving as chairman of the Advanced Technologies Laboratories Advisory Board.

**Robert B. Whitrock** has been named custodian of collections, fossil invertebrates, for the Department of Geology. A native of New York City, Whitrock received his B.S. from the State University of New York, at Stony Brook, and his M.A. from Queens College of the City University of New York. A major responsibility of Whitrock's will be to reorganize the fossil invertebrate collection.

**Oscar Anderson,** Field Museum's printing production coordinator and *Bulletin* production manager since 1974, was elected in June as president of the Society of Typographic Arts, a Chicago-based organization. The society's membership is primarily graphic designers and those in related fields.

**Mari F. Mullen** has joined the Public Relations Department as public relations assistant. Most recently, Ms. Mullen served for a year and a half in the Office of Communications of the Archdiocese of Chicago. A native of Wilmette, Ms. Mullen attended Newton College, Mass., for two years and graduated with a B.S. in speech from Northwestern University in 1976.

**Lawrence Klein,** chairman of the De-

*Women's Board presidents, past and present. Shown here at a recent Women's Board function are (l. to r.) Mrs. Edward F. Swift (current president), Mrs. Joseph E. Rich (president 1976-1978), Mrs. Thomas E. Donnelley II (1974-76), Mrs. B. Edward Bensinger (1972-74), and Mrs. Edward Byron Smith (1970-72). Mrs. Hermon Dunlap Smith (1966-70), founding president, died in 1977.*

*Gerald Durrell with young gorilla friend*

partment of Exhibition, has resigned to accept a position in private industry in Los Angeles. Klein joined the Museum staff in January, 1976.

**Alice Carnes,** chairperson of the Department of Education, has resigned to accept the directorship of the Museum of Natural History at the University of Oregon, Eugene, Ore. Dr. Carnes joined the Field Museum staff in 1972 as coordinator of teacher training and, in 1974, was named chairperson of the department. Carolyn Blackmon, head of the department's division of public programs, has been named acting chairperson.

### Gerald Durrell Lecture

Saturday, Sept. 23, at 2:00 p.m. is the time to see and hear noted writer, conservationist, explorer Gerald Durrell. He will appear in James Simpson Theatre and speak on "The Stationary Ark." Tickets for the event are $1.50 for members, $3.00 for nonmembers. If tickets are sold out in advance, a repeat lecture will be offered on Sunday, Sept. 24.

Born in India in 1925, Durrell began financing, organizing, and leading expeditions to the lesser known parts of the world more than 30 years ago. He acquired specimens for the major zoological gardens of Europe and America and contributed 22 species new to the collection of the Zoological Society of London. He has also collected for the British Museum, Edinburgh University, the Wildfowl Trust at Slimbridge, Eng., and the Jersey Wildlife Preservation Trust.

For Gerald Durrell lecture tickets please send coupon below (or facsimile) to:
PROGRAMS: Education Department
Field Museum of Natural History
Roosevelt Rd. at Lake Shore Dr.
Chicago, Ill. 60605

Film Lecture "The Stationary Ark"
Presented by Gerald Durrell
Sept. 23, 2:30 p.m.
James Simpson Theatre

last name _____ first name _____

street _____

city _____ state _____ zip _____

Phone _____ daytime _____ evening

I am a member ☐ nonmember ☐

Member $1.50 Nonmember $3.00
Number of tickets requested _____
Amount of check enclosed $_____
Seating limited to 950.
Please use west entrance.

☐ Yes, you may send ticket(s) for Sept. 24, 2:00 p.m. if the Sept. 23 lecture is sold out.

Tickets will be mailed upon receipt of check.

Refunds will be made only if program(s) are sold out.

Be sure to enclose self-addressed, stamped envelope for the return of tickets.

FIELD BRIEFS con't on p. 19

*Rock temples at Abu Simbel. The stone figures were recently cut free from the cliff and moved to higher ground.*

# Egypt Tours for Members

**Remember the summer of '77** and the excitement of the Tutankhamun Exhibition at Field Museum? A second thrill can now be yours: visiting the land where the boy-king ruled over 3,300 years ago, via Field Museum's tours to Egypt. Highlighting each of the two tours will be a descent into Tutankhamun's tomb—the single greatest find in archaeologically rich Egypt.

**Our 19-day tour** will also expose you to a culture that continues today much as it did centuries ago. Your guide will be a professional Egyptologist—a scholar who is familiar with the history, art, and culture of ancient Egypt. The itinerary includes Beni Hassan, and Ashmunein—important for their remains of the Middle Kingdom, Luxor and Karnak Temples, the West Bank with its Colossi of Memnon, the Ramesseum, the Village of Deir el Medineh where some of the finest New Kingdom tomb paintings are found, the Valley of the Queens and that of the Kings, the Tombs of the Nobles including Menna, Ramose, and Sennefer, Dendereh, with its Ptolemaic and Roman Temple complex, Abydos, Esna and its temple of the ram-headed god Khnum, Kom Ombo and Aswan. A Sound-and-Light performance at Karnak is on the agenda.

**There are two departures** after January 1, 1979; the maximum size for each group will be 24. Each tour features a 5-day cruise on the Nile River aboard the deluxe *Isis* or *Osiris* diesel cruisers as well as deluxe hotel accommodations (except one night in Minia where the best Egyptian hotel will be used). For further information and a detailed itinerary, please write or call Dorothy Roder, membership secretary, Field Museum (922-9546).

# CLOSE ENCOUNTERS OF THE ZERO$^{th}$ KIND

*Barringer Crater, near Flagstaff, Arizona, is 3,900 feet across and 600 feet deep. Its age is estimated at between 30,000 to 50,000 years. Barringer shows the typical upturned rim of an explosion crater, a feature also to be seen on lunar craters.*

BY EDWARD J. OLSEN

In the past year outer space is once more as exciting as it was in the days of Sputnik and the landings on the moon. It's all because of a rip-snortin', shoot-em-up, space-opera called "Star Wars," and an imaginative fantasy surrounding visits to earth by gentle, alien creatures in "Close Encounters of the Third Kind." On top of these, we were recently "entertained" by a television film built around an impending collision between a small planet (asteroid) and our earth. Of the three films, the only one with a reasonable probability of actually happening is the last one—a collision with an asteroid.

In fact, within the past 50 years the earth has had several close encounters with passing asteroids. The closest was back in 1937, when an asteroid with the poetic name "Hermes " passed within 465,000 miles of the earth. More recently, in October, 1976, an asteroid with a rather austere scientific name, "1976 UA," approached the earth within 726,000 miles. These distances may seem large, but in terms of space they are considered near misses!

Hermes and 1976 UA are members of a group of asteroids, the Apollo Asteroids, that move around the sun in orbits that cross the earth's orbit. They range in size from small pieces up to a few miles in diameter. The effect of a collision with any such object would be catastrophic of course. An impact on land would blast out a lunar-sized crater, and if it landed in an ocean the shock waves would devastate the margins of bordering continents, totally destroying seacoast cities. All it takes to have such a smashingly close encounter is for one of these asteroids, like Hermes, to cross the earth's

---

*Edward J. Olsen is curator of mineralogy.*

orbit when the earth itself is sailing along at the same point.

Of course, such collisions happen thousands of times a day when very small bits of planetary material, meteorites, hit the earth's outer atmosphere, are heated to brilliant incandescence by friction with the air, and plunge earthward at speeds up to 100,000 miles per hour (50 km/sec). If it weren't for the earth's thick atmosphere we would be constantly blasted, mainly by sand-sized particles of stone and iron and occasionally by chunks up to a few feet across.

Happily, all but a few hundred a year burn up. Those that make it through to the surface are usually so small that there is little chance they'll do much damage. Occasionally one hits a building and, of course, the probability always exists that a person could be hit.

Impacts of these smaller meteorites, while posing a hazard, are trivial compared to the effects of a collision with an asteroid. The results of these encounters are abundant in the parts of the solar system we have explored by space probes. The surface of our moon is pocked with hundreds of thousands of impact craters, and the planet Mercury has a surface that is difficult to tell from that of the moon—again thousands of craters. The surface of Mars is more complicated, having both volcanic structures and erosional canyons; however, it too has an abundance of impact craters.

What about the earth? Obviously the earth has been hit by asteroid-sized objects. There is no way for the moon to be so battered and the earth entirely escape. The earth has, however, ways of patching up and modifying its scars. It has an atmosphere, and water. A large crater on earth, especially one formed long ago, suffers rain and wind erosion, infilling with sediments the effects of crustal movements (faults, fractures, and folds), and, ultimately, erasure by all of these processes. Nevertheless, in spite of all the forces working against them, a few asteroid impact scars have survived.

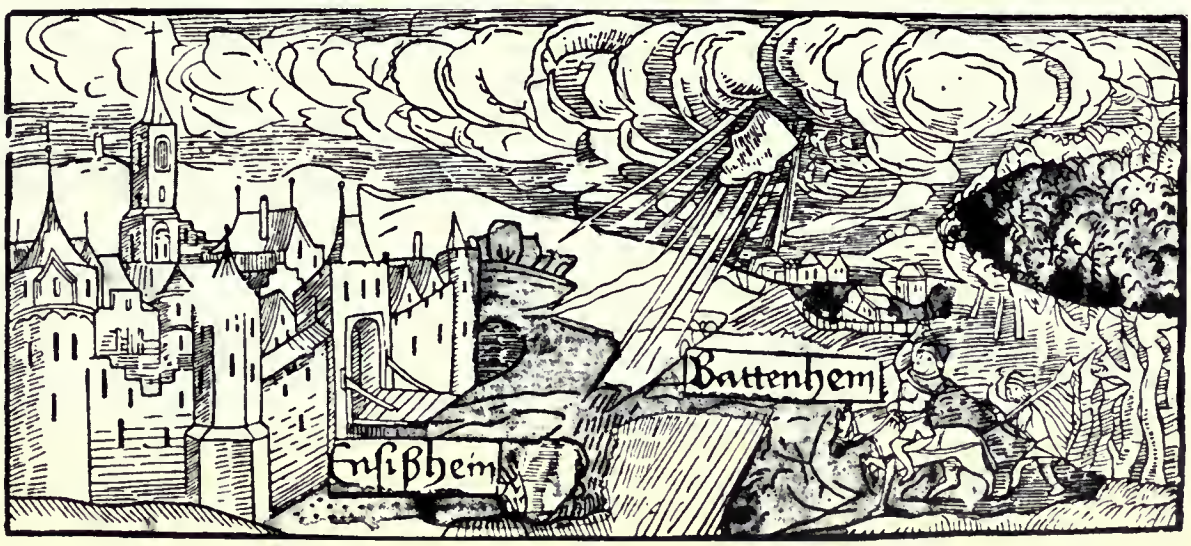
The most famous one is the Barringer Crater, near Flagstaff, Arizona. It has the typical shape of an impact crater: a rounded hole, 3,900 feet across and 600 feet deep, an upturned rim, and heavily fractured and disjointed rocks. This crater is fairly young, estimated at only 30,000 to 50,000 years old. But even in the dry environment of the Arizona desert it is already showing signs of being slowly erased. The shape, when viewed from directly overhead, is not quite circular anymore, but is beginning to distort slightly because of weathering along a regional fracture pattern that was in the bedrock before the impact took place. In some spots the rim is being worn down by wind and the infrequent, but sometimes heavy rains. In spite of this it still has the telltale shape and proportions shown by the thousands of lunar impact craters.

To understand this shape we must consider what happens when a very high-speed, heavy mass hits the earth. If it is massive enough, 100 tons and up, its speed is virtually unaffected by friction with the earth's atmosphere. Its total energy, by virtue of a law of physics, is proportional to its mass and to the square of its velocity. When it impacts the earth, and stops moving, something has to happen to all of its energy. What happens is, the object's temperature goes up very rapidly, to a point where it vaporizes—which is to say, it explodes like a gigantic bomb!

To get an idea what kind of explosive energy we could expect, let's consider an asteroidal impact. If the asteroid is traveling at 50 km per second (112,000 mph), is made of stone, and is 2 km (1.2 miles) in diameter, it would impact with an energy equivalent to *four trillion tons of TNT,* blasting a hole 33 km (20 miles) across and 2.8 km (1.7 miles) deep! (Figuring this in terms of calories of energy, as food calories are reckoned, it is equivalent to a total caloric value of one million times more hamburgers than McDonald's has sold to date!)

The Barringer Crater is an easy example for many Americans to see. It lies conveniently just off a major highway, U.S. 66, between Winslow and Flagstaff, Arizona. Also, some commercial airlines, flying from Chicago to Los Angeles or San Diego, go right over it. From the size of the crater it is estimated that the impact explosion had an energy of 53 million tons of TNT. If it hit the earth at, say, 50 km per second, then its original mass would have been close to 170 tons. Because some parts of the original object have survived the explosion and are found scattered around the outside of the crater, we know that it was a solid iron meteorite which, at impact, must then have been about 115 feet in diameter.

*Old woodcut of a meteorite falling upon Ensisheim, Germany, on November 16, 1492*



Nearest Approaches of Recent Asteroids to Earth

| asteroid | year | closest approach to earth |
|---|---|---|
| *Adonis* (1936 CA) | 1936 | 930,000 miles (1,500,000 km)* |
| " | 1943 | 7,440,000 miles (12,000,000 km) |
| " | 1977 | 13,485,000 miles (21,750,000 km) |
| *Hermes* | 1937 | 465,000 miles (750,000 km) |
| *1976 UA* | 1976 | 725,400 miles (1,170,000 km) |
| " | 1983 | 9,067,500 miles (14,625,000 km) |

**For comparison, our moon's distance from Earth is, on the average, about 237,000 miles.*

*On September 29, 1938, the meteorite held in the man's left hand fell through his garage roof at Benld, Macoupin County, Illinois, through the roof of the automobile and the back seat cushion, through the wooden floor boards, and bounced off the muffler, lodging in the seat cushion. Now on view (with damaged parts of the automobile) in Hall 34, the 4-pound, stone meteorite was described by a witness as "sounding like an airplane going into a power dive" as it sped to earth.* ▼

Barringer Crater isn't the only scar to be seen. In 1943 a U.S. Army Air Corps plane flying over the barren lands of extreme northern Quebec, Canada, observed and photographed a huge, circular lake in the midst of a terrane of the usual irregularly shaped lakes. In 1950, a prospector, F. W. Chubb, noticed the unusual shape on the air photograph and brought it to the attention of Victor Meen of the Royal Ontario Museum. The remote area was visited, studies made, and a new impact crater was recognized. It was originally called Chubb Crater, but has now been officially renamed the New Quebec Crater. It is blasted into granite, and made a hole 2.1 miles across and almost 1,000 feet deep. To excavate that volume the blast would have been equivalent to almost two billion tons of TNT! There is no good way to determine its age, but estimates are between 10,000 and 20,000 years old.

Because of this crater, Canadian scientists, especially C. S. Beals and M. Dence, became deeply interested in crater searches in Canada. Over the years they have examined close to half a million air photographs and have discovered over a

# LOCATIONS OF TERRESTRIAL IMPACT STRUCTURES

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

1 Al Umchaimin Crater, Iraq
2 Amak Island Crater, Alas.
3 Amguid Crater, Algeria
4 Aouelloul Crater, Mauritania
5 Arnhem Land Crater, Australia
6 Baghdad Craters, Iraq
7 Barringer Crater, Ariz.
8 Basra Crater, Iraq
9 Boxhole Crater, Australia
10 Brent Crater, Canada
11 Campo del Cielo Craters, Argentina
12 Carolina Bays, U.S.A.
13 Carswell Lake structure, Canada
14 Chinge site, U.S.S.R.
15 Clearwater Lakes, Canada
16 Crater Elegante, Mexico
17 Creatone Crater, Colo.
18 Crooked Creek structure, Missouri
19 Dalgaranga Crater, Australia
20 Decaturville disturbance, Missouri
21 Deep Bay, Canada
22 Des Plaines disturbance, Illinois
23 Duckwater Crater, Nev.
24 Dycus disturbance, Tennessee
25 Dziona Craters, Algeria
26 Ellef Ringnes Island Craters, Canada
27 Eyre Peninsula Craters, Australia
28 Flynn Creek structure, Tennessee
29 Franktown Crater, Canada
30 Glasford structure, Illinois
31 Glover Bluff structure, Wisconsin
32 Gulf of St. Lawrence arc, Canada
33 Gwarkuh Crater, Iran
34 Hagens Fjord Craters, Greenland
35 Haviland Crater, Kans.
36 Henbury Craters, Australia
37 Hérault Craters, France
38 Holleford Crater, Canada
39 Howell structure, Tennessee
40 Hungarian Plain, Hungary-Romania
41 Ilumetsa Craters, Estonia
42 Jeptha Knob structure, Kentucky
43 Ka-imu-hoku, Hawaii
44 Kaalijärv Craters, Estonia
45 Kalkkop structure, South Africa
46 Keeley Lake, Canada
47 Kentland structure, Indiana
48 Kilmichael structure, Missiasippi
49 Köfels site, Austria
50 Lac Couture, Canada
51 Lake Bosumtwi, Ghana
52 Lake Dellen, Sweden
53 Lake El'gytkhyn, U.S.S.R.
54 Lake Humeln, Sweden
55 Lake Michikamau, Canada
56 Lake Mien, Sweden
57 Lake Siljan, Sweden
58 Lonar Lake, India
59 Macamic Lake, Canada
60 Malha Crater, Sudan
61 Manicouagan-Mushalagan Lakes area, Canada
62 Manson structure, Iowa
63 Mecatina Crater, Canada
64 Melville Island Craters, Canada
65 Menihek Lake area, Canada
66 Merewether Crater, Canada
67 Merriwell Lake, Canada
68 Middlesboro Basin, Ky.
69 Morasko Craters, Poland
70 Mount Doreen Crater field, Australia
71 Murgab Craters, U.S.S.R.
72 Nastapoka Islands arc, Canada
73 Nebiewale Crater, Ghana
74 New Mexico Crater, N. Mex.
75 New Quebec Crater, Canada
76 Odessa Craters, Tex.
77 Panamint Crater, Calif.
78 Paris (Sucy-en-Brie and Alentours) lakes, France
79 Parry Sound Crater, Canada
80 Patomskii Crater, U.S.S.R.
81 Pilot Lake, Canada
82 Pretoria Salt Pan, South Africa
83 Richât Crater, Mauritania
84 Rieskessel, Germany
85 Ssult au Cochona structure, Canada
86 Sayan Crater, U.S.S.R.
87 Semsiyât dome, Mauritania
88 Serpent Mound structure, Ohio
89 Sierra Madera structure, Texas
90 Sikhote-Alin Craters, U.S.S.R.
91 Socotra Crater, Socotra
92 Steinheim Basin, Germany
93 Sudbury Basin, Canada
94 Talemzane Crater, Algeria
95 Temimichât-Ghallaman Crater, Mauritania
96 Tenoumer Crater, Mauritania
97 Tiffin Crater, Iowa
98 Tunguska event, U.S.S.R.
99 Tvären Bay, Sweden
100 Ungava Bay, Canada
101 Upheaval Dome, Utah
102 Versailles structure, Kentucky
103 Vredefort structure, South Africa
104 Wabar Craters, Saudi Arabia
105 Wells Creek area, Tennessee
106 West Hawk Lake, Canada
107 Wilbarger dome, Texas
108 Wilkes Land structure, Antarctica
109 Winkler Crater, Kans.
110 Wolf Creek Crater, Australia

*The Tunguska explosion, which occurred in central Siberia on June 30, 1908, flattened the spruce trees on this hillside. Scientists now believe that the exploding body was an icy comet, about 131 feet in diameter, that vaporized about six miles above the earth. Dusty residue in the atmosphere continued to create colorful sunsets for months afterward.*

dozen large circular structures. Some of these have been studied in enough detail to show they are very probably impact craters and not just round shapes on the land.

Two of them are especially interesting, the Brent Crater and the Holleford Crater. One contains two small lakes, but neither one is a gaping hole, as are the Barringer and New Quebec Craters. The reason is, each one is a crater, blasted in granitic rock, and filled in with early Paleozoic sediments, 500 million to 600 million years old. In other words, these craters were created over 600 million years ago, were filled by later sedimentation, and are now being re-excavated by the slow process of erosion. Brent is 2 miles across, while Holleford is 1.5 miles across. The sedimentary rock cover helped preserve these craters for half a billion years.

One of the Canadian impact sites of spectacular size, 37 miles across, is visible on ordinary maps of Canada, as seen in a good home atlas, or on a road map of Quebec. Just about 325 miles northeast of the city of Quebec are two lakes, Manicouagan and Mushalagan, that look like a pair of "parentheses." Each lake is narrow and semicircular. Mushalagan looks like a normal letter C, while Manicouagan looks like a C turned backwards. Together they describe a 37-mile-diameter circle. Within the circle, the rocks are full of features that tell of past blasting and crushing. Again there is no hole. What this represents is the eroded base of an ancient and very large impact crater.*

*Recently the outlets to these lakes have been dammed up to provide a reservoir. The result has been to form a completely circular lake, which can be seen on more recent maps.

On a worldwide bases, over the past two decades, more than 80 suspected circular sites have been studied, from the little Dalgaranga Crater in Australia, 230 feet across, to the 25-mile-diameter Vredefort Ring in South Africa. In some cases, good evidence is found for a meteorite impact. In other cases it is lacking and only a circular shape exists to taunt us about what it might mean.

A crater isn't necessarily formed at all impact events. If the impacting body is made up of material that is not strongly held together its penetration into the atmosphere of the earth could slow it enough to cause it to explode before actually getting to the ground. That is what happened in one of the most popularized collisions in written history. Just about every year some newspaper in the country features this event as it if were newly discovered. It is usually played up as a "mysterious explosion in Siberia that baffles scientists." Admittedly, it was a baffler for about 50 years, but its cause was finally worked out in the late 1950s.

The event happened during the pre-dawn hours of June 30, 1908. A tremendous explosion took place in the air, miles up, above the isolated Podkamenaia Tunguska River in central Siberia (60°55'N, 101°57'E). Although it was a sparsely populated region, the blast was felt over a huge area, about 1,000 miles in diameter. Eyewitnesses saw a huge fireball racing northwestward, followed by a deafening explosion and brilliant flash that lit up the night sky. Within 300 miles of the blast, buildings shook, windows cracked, and people were swept from their feet, some reporting a sensation of heat.

Far away, in Germany and England, barographs recorded a passing high pressure wave in the air that came by within a few hours of the blast, passed around the entire

earth, and then passed back in the reverse direction, almost 26 hours later, much diminished in strength. For two months after the explosion, until late August, the sky at night over Europe and Siberia was bright due to high altitude dust particles suspended in the air.

Today such an event would have received immediate attention. But this was the time of politically turbulent Russia, just before the revolution. Because of World War I and the post-revolution turmoil, the site was not visited until 1927, when L. A. Kulik led an expedition there for the Academy of Sciences of the USSR. It was 19 years after the event, but what a sight greeted Kulik's eyes.

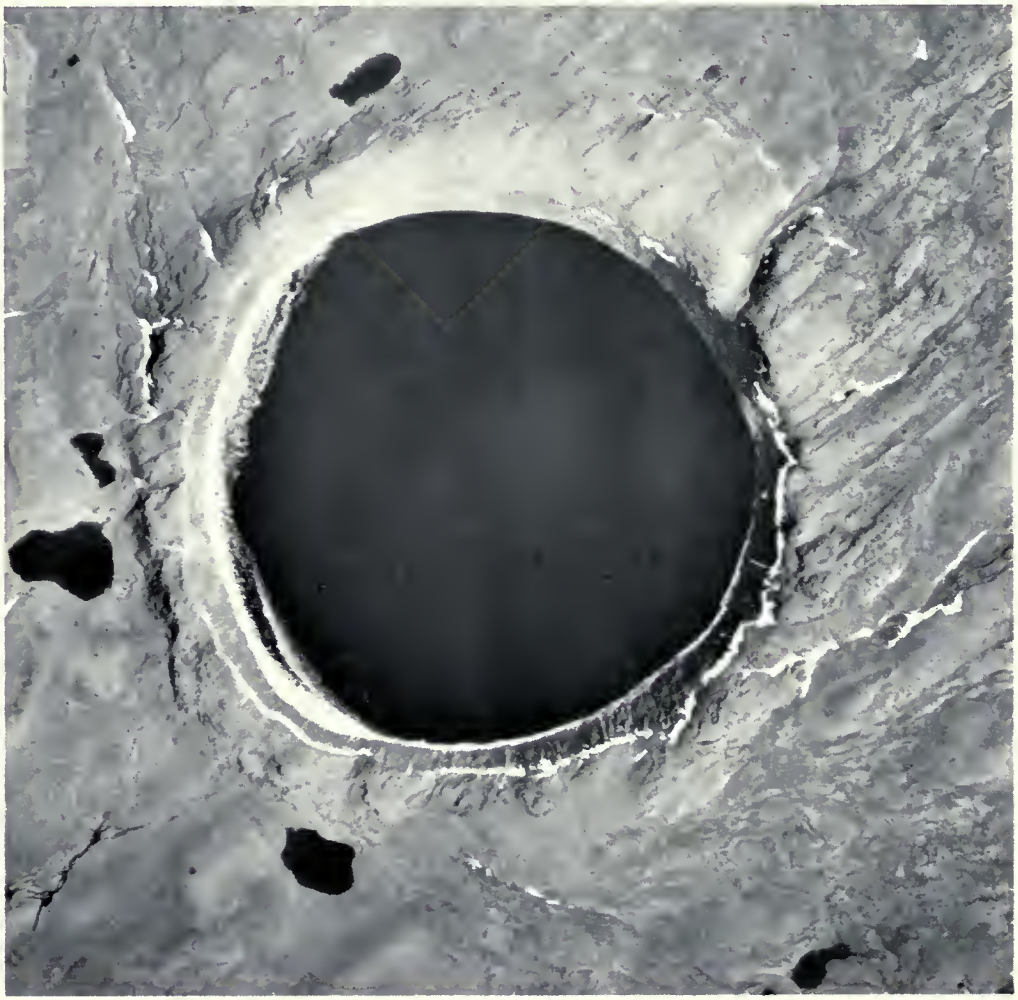
For an area 40 to 50 miles in diameter thousands of spruce trees were flattened to the earth, all pointing radially away from the ground immediately under the blast, like the spokes of a giant wheel. The dead trees within an inner 20

Reproduced courtesy Energy, Mines, and Resources Canada ©Government of Canada

*Holleford Crater, in Ontario, Canada, is visible only from the air. About 1.5 miles across, it was blasted into Pre-Cambrian rocks more than 600 million years ago and subsequently filled in with sediments. Differences in the soil formed from the two kinds of rock, inside and outside the crater, are responsible for the vegetation and erosion differences, visible here.*

mile diameter showed burn and scorch marks on their bark and branches. Kulik set to work to find meteorite fragments—and found nothing. Nor was there a crater—only flattened trees and arctic swamps.

More expeditions were undertaken, seven more of them, up until 1961. No hint of any meteorite or asteroid was ever found. In the meantime, at laboratories in Moscow, experiments and calculations gradually uncovered what had happened. What kind of object could hit the atmosphere of the earth, explode before hitting the ground and leave no trace of itself? To find the answer to this we must make a short digression.



Reproduced courtesy Energy, Mines and Resources Canada ©Government of Canada

*New Quebec Crater (formerly Chubb Crater) in northern Quebec, Canada. The water-filled structure is 2.1 miles across, almost 1,000 feet deep, and was blasted into granite.*

In the early 1930s, the American astronomer, Fred Whipple, showed there is only one way to account for all the observed properties of comets. They have to be made mainly of masses of ice, within which are grains of stony dust—what he called "dirty snowballs." Data gathered by orbiting satellites within the past few years have substantiated his description. We now feel quite certain that comets can vary in their proportion of stony material, from those that have mainly stony particles, held together by a small amount of ice, all the way to those that have mainly ice, with just a small amount of dust.

Every year comets pass the earth, go around the sun, and return out to the far reaches of the solar system. Most of these are small. Today, with so many telescopes, very few small comets escape attention. Back 70 years, however, only larger comets were noticed. Small ones could easily go by undetected.

In those days it would be very easy for a small, dim comet to pass the sun unnoticed, and on its return, heading back out into space, run right into the earth. As it approached the earth, looking larger and larger, one would think it would be seen. On such a path, however, it would be coming *from the direction of the sun*—that is, it would have been visible only in the daytime. To be noticed it would have to have been exceedingly large and bright. Even the largest comets are not bright enough to be seen in the daylight—and a small one would never be seen.

As a cause for the Siberian explosion, all lines of evidence point to a small comet that sneaked up on the earth from the sunward side and pushed into the upper atmosphere at high speed. The comet consisted mainly of ice with some dust. Because ice is a brittle material, it fractured and

*Wolf Creek Crater, in Western Australia. The structure is 2,800 feet across and 160 feet deep. The flat bottom is due to partial infilling by desert sediments.*

exploded about 6 miles up—turning entirely to water vapor except for the dust, which took months to settle, causing the bright night skies seen after the explosion. The blast wave traveled downward, knocked down trees, and sent a shock wave around the earth.

From an analysis of the shock wave, as it showed up on barographs at various places in Europe, it has been possible to calculate the energy of this explosion—an energy equivalent to 10 million tons of TNT. From this, we calculate that it took an icy comet of only 131 feet in diameter to make the much publicized Tunguska explosion! Had it occurred over a populated region, this explosion would have caused enormous injury and destruction.

From the impact craters that are known on earth we see that we are potentially a target. Impacts from comets can do similar damage without leaving craters.

So far, the largest crater known on earth is the Manicouagan-Mushalagan Crater in Canada, 37 miles across. Yet on the moon we know of craters that range up to many hundreds of miles. The earth has obviously suffered impacts from very large objects. The question is whether there are any scars left from impacts by objects as large as those that produced the largest craters, called the *maria basins*, on the moon.

It is an absorbing exercise to look over maps of various parts of the world and search out really large round shapes. Here in North America there are three such intriguing areas. One of them is the very rounded embayment along the east side of Hudson Bay. It is an arc of an almost perfect circle of 275 miles diameter. This arc, called the Nastapoka Arc, has been studied in much detail to determine if it is a portion of a huge, ancient crater. It would have taken an asteroid of 33 miles diameter to blast a hole of such size. All the investigations to date have yielded negative results. It is apparently just a rounded shape on the land, without an explanation.

The same is true of the large arc, 190 miles in diameter, that is formed by the coasts of Nova Scotia and New Brunswick—the Gulf of St. Lawrence. It has apparently nothing to do with an asteroid impact.

Finally, there is the arc made by two of the Great Lakes—Lake Michigan and Lake Huron. Together they bracket the state of Michigan like a pair of parentheses, 330 miles in diameter. They form the rim of a large geologically downwarped, sedimentary rock-filled, circular basin, called the Michigan Basin. Again, though it is an intriguing idea, it appears not to have anything to do with an impact.

Among the Apollo asteroids, which are in earth-crossing orbits and potentially capable of impacting the earth, none are of the order of tens of miles in diameter. Yet, as we have seen, an object like the Tunguska comet, less than a few hundred feet across, can create devastating effects on impact. The table shown on page 8 lists some of the close encounters in the recent past, and into the near future, by three of these asteroids. Altogether there are 21 asteroids known in this group, though the orbits of many of them are not well determined. About 15 years ago an astronomer made an error in a calculation and predicted the Apollo asteroid, Icarus, was going to impact the earth. Within a few weeks another astronomer corrected the error and predicted a wide miss. Nevertheless, it caused quite an uneasy stir among more impressionable people, some of whom became hysterical and thought the earth would be entirely destroyed. As we have seen, objects the size of these asteroids, a mile or two in diameter, are capable of blasting craters only a few tens of miles across—a far cry from destroying the earth. *Where* such an asteroid impacts, however, is of considerable importance. An impact in a highly populated area would be the largest single catastrophe ever to take place.

Looking out into the star-filled heavens on a summer night gives one a feeling of serenity and peace. Nothing out there looks dangerous. Yet we know from the marks left on the earth that at times in the past the earth has been the target of passing asteroids and comets. The probability exists it could happen again.

As you look at the night sky and notice, perhaps, that one pinpoint of light, from what you thought was a star, seems to be getting brighter and larger as you watch it, you may be an unwilling witness to a new close encounter—of the zero$^{th}$ kind!

# World Music Program For Members' Children

*WITH* IRA KERSH

The program introduces children to several cultures around the world through musical instruments, songs, games, and stories. Ira Kersh has traveled in all of the countries represented, visiting with people and studying their culture, folklore, and music. The program focuses on daily life in other cultures, and students can handle and play musical instruments from each of the cultures.

**Series I, September 9, 16, and 30th**

**Series II, October 7, 14, and 21**

Each series will consist of three consecutive one-hour Saturday programs. Each program in a series will focus on a different culture and will be aimed at specific grade levels. Series II is identical to Series I.

**Program 1 Music of Asia**

The music of Asia becomes more understandable and dramatic as children have the opportunity to use a collection of instruments from Tibet, India, Thailand, Indonesia, and China. Tapes of selected music will be interspersed in small segments to provide another musical perspective.

**Program 2 Music of Southwestern Indians**

Games, stories, and demonstrations about music and dance will be presented. Students will enjoy learning the art of making "Ojos de Dios" (God's Eyes), an ancient Indian handicraft that originated with the Huichol Indians of Mexico.

*Ira Kersh*

**Program 3 Indonesian Wayang Shadow Puppets**

After an introduction to puppets and their use in shadow theatre, a shadow screen will be set up. Some students will manipulate the puppets and present a short play; others will provide music to accompany the action on anklungs (bamboo rattles).

**Grade levels**

| | |
|---|---|
| 10 a.m. | Kindergarten and 1st grade |
| 11 a.m. | 2nd and 3rd grades |
| 1 p.m. | 4th and 5th grades |
| 2 p.m. | 5th, 6th, and 7th grades |

Each series is limited to 50 participants per grade level. A few single tickets may be available; call 922-9410, extension 363 after September 5 for information.

*Please use west entrance to Museum.*

**WORLD MUSIC PROGRAM**

For tickets please send coupon (or facsimile) to: PROGRAMS: Education Dept.
Field Museum of Natural History
Roosevelt Rd. at Lake Shore Dr.
Chicago, Ill. 60605

_____
last name first name

_____
street

_____
city state zip

_____
daytime phone evening phone

$3.00 per series
Check one: Series I ☐ Series II ☐
Check appropriate time for your grade level:
10 a.m. ☐ 11 a.m. ☐ 1 p.m. ☐ 2 p.m. ☐
Number of tickets requested _____
Amount of check enclosed _____
Enrollment limit: 50 per grade level.
Tickets will be mailed upon receipt of check. Refunds will be made if program is sold out.

Be sure to enclose self-addressed, stamped envelope for the return of your tickets.

# MAZON CREEK CENSUS

*Strip mine spoil heaps at Pit 11* Gordon C. Baird

## *sampling 300,000,000-year-old populations of Illinois fossil beds*

**By Gordon C. Baird**

LOOMING ABOVE THE CORNFIELDS, an hour's drive southwest of Chicago, are gray, cone-shaped hills which may catch the traveller's eye as he motors along Interstate Highway 55. These hills, notable for their drabness and symmetry, are evidence of a system of abandoned coal mines that extends both across and under 40 square miles of Will, Grundy, Livingstone, and Kankakee Counties. From the mid-1860s until the mid-1970s, when the last mine closed down, these shaft (underground) and open pit (strip) mines yielded millions of tons of bituminous coal. Today only these desolate hills of waste rock and the furrowed moonscapes of the depleted strip mines bear witness to that bygone industry.

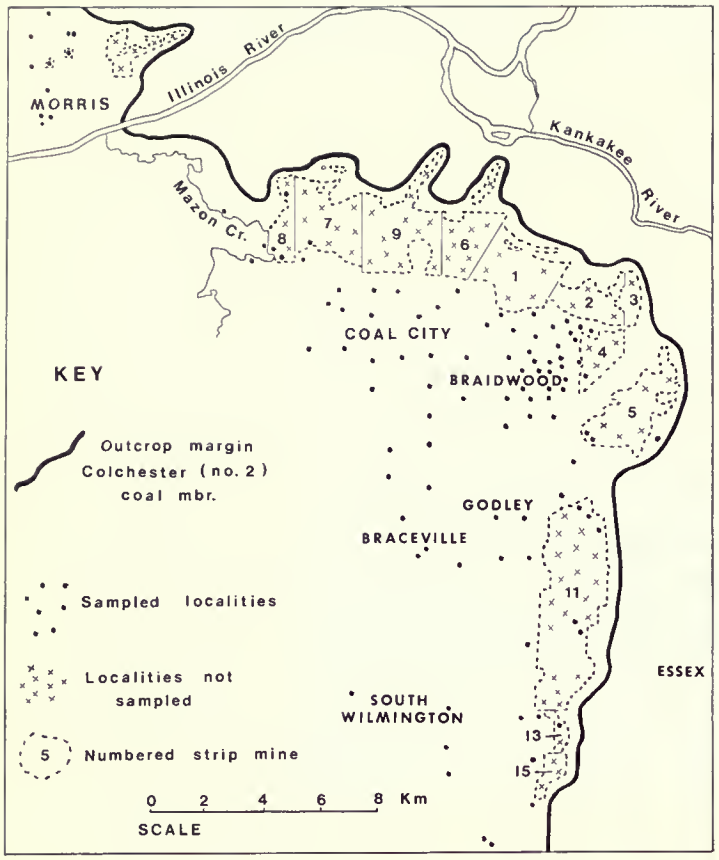
To the paleontologist, however, these mined-out areas are neither desolate nor depleted, for they contain abundant fossils, including forms that are both unusual and spectacular. This region of fossiliferous mines, known to fossil collectors and paleontologists as the Mazon Creek area, is one of the greatest fossil localities in the world.

Sedimentary rock (one of the three basic kinds of rock) commonly yeilds fossils, but what makes the sedimentary deposits of the Mazon Creek area extraordinary is the superb preservation of the fossil specimens and the richness of species. More than 350 plant species have been found there, including ferns and a variety of ancestral fernlike plants. Parts of plants including leaves, bark, roots, seeds, and wood are abundant at many Mazon Creek localities. Animal specimens found in the area total more than 320 species, including numerous soft-bodied forms such as worms, sea cucumbers, larval fish with yolk sac still attached, and even jellyfish, which are rarely preserved as fossils.

In addition to Mazon Creek's preservational wonders, more than a score of important new fossil species have been described from there, including the earliest known isopod (a crustacean), the earliest known squid, and the earliest known chaetognath and nemertine (both marine worms). Other prize discoveries have been the only known fossil lamprey, the only fossil hydra, and the only fossil priapulid (a marine worm). Several species have been discovered whose placement in the animal kingdom is still unknown; these include the bizarre, wormlike "Tully monster."

---

*Gordon C. Baird is assistant curator of fossil invertebrates.*




Field Museum scientists have played a significant role in the study of Mazon Creek fossils, notably Eugene S. Richardson, curator of fossil invertebrates. Much of Richardson's work has dealt with the systematics (classification) of major groups such as clams, cephalopods, cartilaginous fishes, crustaceans, and worms. The late Ralph G. Johnson, a Field Museum research associate and University of Chicago faculty member, worked with Richardson in describing major animal communities in the Mazon Creek area. Richardson and Johnson recognized two major animal associations: the Braidwood and Essex faunas. The Braidwood fauna, representing fossils from strip mines near Morris and Braidwood, Illinois, contains freshwater animals including insects, amphibians, horseshoe crabs, and freshwater shrimp; the Braidwood fauna is also associated with abundant plant fossils. The Essex fauna is composed of marine or brackish water animals including jellyfish, polychaete worms, marine shrimps, sea cucumbers, and several forms that do not fall conveniently into existing classifications.

Mazon Creek fossils occur within ironstone concretions (characteristically lima bean-sized to football-sized, ovoid, slightly flattened nodules of iron carbonate) which formed around the organisms immediately after they were covered with mud, silt, or sand. The fossiliferous concretions occur in stratified mudstone or silty shale formally known as the Francis Creek Shale Member, found above the coal which was mined. The conical gray hills seen by the passing motorist are piles of this shale that has been excavated from underground mine shafts or been shovelled aside in strip mining. It is on the surface of these waste piles that loose, weathered-out concretions are typically found.

Animal and plant fossils in the Mazon Creek area are nearly 300 million years old, belonging to that segment of geological time known as the Pennsylvanian Period, or the "Coal Age." During this period extensive coastal swamps developed and peat deposits formed; later these would gradually turn to coal.

The Francis Creek Shale was deposited along the north-

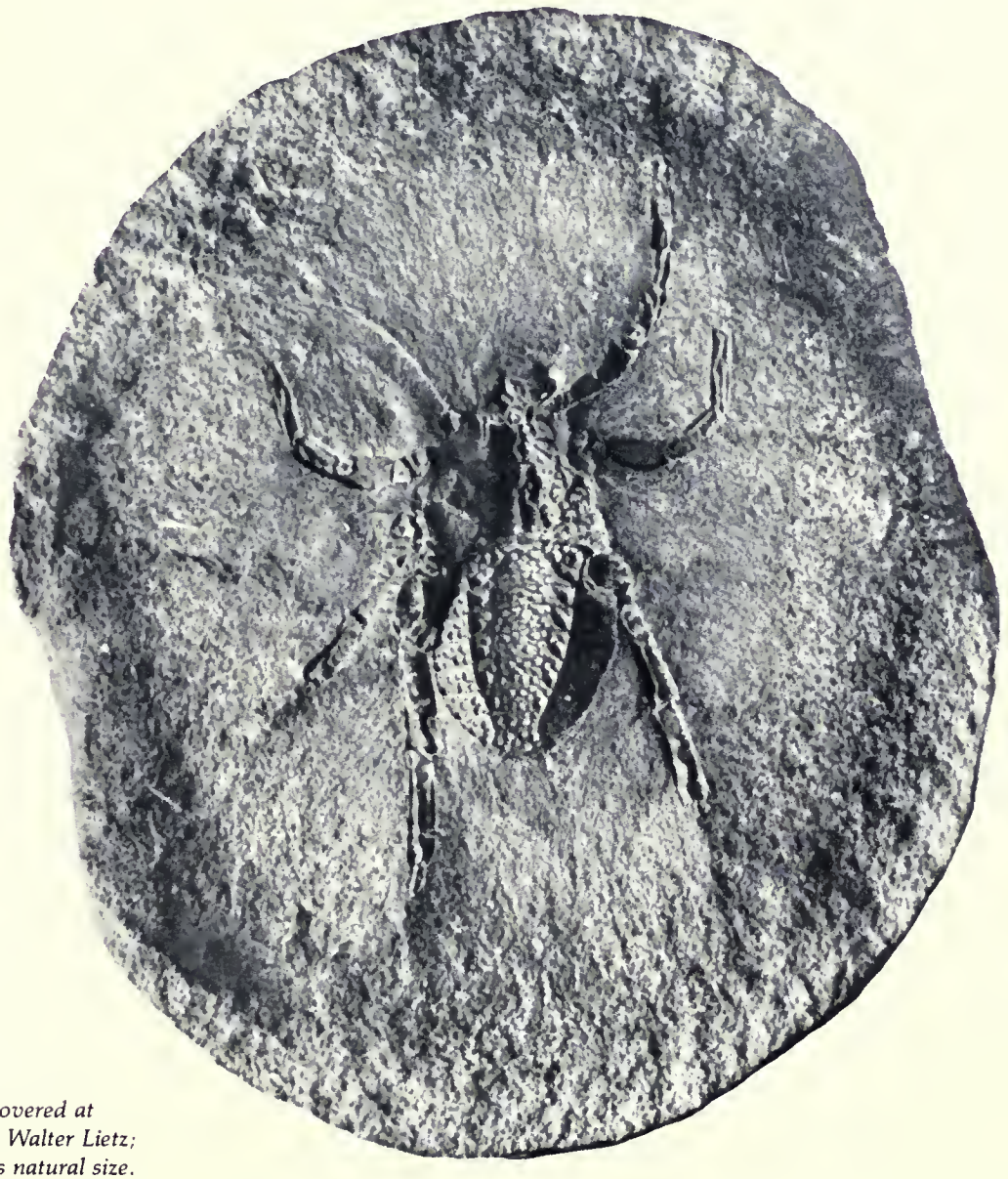
*Fossil of "Tully monster"* (Tullimonstrum gregarium)*; about ½ natural size.*

eastern shores of a broad, shallow inland sea which once covered much of the continent, including most of Illinois. One or more rivers emptying into this sea created a delta of sediment which, in time, turned to rock.

As the delta was gradually being formed and fanning outward, the sea level was also apparently rising, and various

stantly flowing water. The result, for the paleontologist, is a crazy-quilt distribution of numerous ancient environments across the Mazon Creek area.

Since my undergraduate days I had known of Mazon Creek and Pit 11 and the fossil treasures they had yielded. However, I knew little about the Mazon Creek area in general



*Spider fossil discovered at Mazon Creek by Walter Lietz; about three times natural size.*

short-lived, transitory environments were produced in the shallow shore waters. From time to time flooding from channels on the delta dumped silt and mud into the adjacent bays. Millions of organisms were buried alive in this mud and, fortunately for the present-day investigator, were beautifully preserved. In the course of time a variety of environments were inundated in this fashion—sometimes the communities involved were marine, sometimes freshwater; sometimes they were in relatively quiet bays, sometimes in channels of con-

and was astonished, upon arriving at the Field Museum, to learn of the great number of other fossil localities in that region. In studying the work that Richardson and Johnson had done, I became intrigued by the idea of investigating these localities, including many that had not yet been examined.

I pored over state mining survey maps and aerial photos, eventually locating more than 20 strip mines and 90 underground shaft mines that had been worked in the area.

*Students collecting fossiliferous concretions from shale bank along Mazon Creek.* Gordon C. Baird

Since most of these localities were little known and some had never been visited by fossil collectors, it seemed reasonable to assume that they, too, could yield new fossil organisms and even fossil assemblages. My plan now was to attempt a comprehensive survey of the faunal and floral associations over the entire area, gaining a better understanding of their distribution and composition.

An initial, but time-consuming step was to sample fossil occurrences in all these localities—in effect, to take a census. Begun about a year and a half ago, this phase is now half finished, with 80,000 concretions collected from 120 localities.

The census data being sought includes taxonomic composition of samples, relative abundance of species, and the preservation quality of fossils at different localities. Generally, if a large number of concretions are present at a particular locality, I collect 500 to 1,000 specimens to get as representative a sampling as possible. At any given locality, all concretions with visible fossils and many whole concretions suspected of containing fossils are collected. Whole concretions are then stored at a Pit 11 field station provided by the Commonwealth Edison Company for the Museum's research activities. Other concretions brought to the Museum are being sorted, washed, and studied by several dedicated Field Museum volunteers.

Concretions to be split open are placed on the Museum's roof in water-filled buckets. The alternate freezing and thawing of the water during the cold months of the year has proven to be an effective means of splitting them open—a technique devised by amateur collector Larry Osterburger. Data from the samples I have collected in the field will be supplemented with census data on collections built up by Osterburger and other amateur collectors. The combined data will be synthesized to yield abundance and location information on the various kinds of fossils collected from the Mazon Creek area. This synthesis is also expected to give us a better understanding of the region's paleoecology and paleogeography.

The census has already revealed that the marine Essex fauna, which occurs over a large part of the Mazon Creek area, appears to be quite variable from locality to locality. In several areas around the towns of Morris and Braidwood it abruptly gives way to the Braidwood fauna. The latter seems to be confined to a narrow belt along the northeast margin of the area underlain by coal age sediments. This distribution pattern, together with the fact that many Braidwood organisms are typically freshwater species, suggests that they lived in ponds, marshes, or streams just above the northeast shoreline of the great inland sea. As additional data is processed, it is hoped that more light will be shed on the nature of the communities and of the ecological conditions that prevailed in northeastern Illinois nearly 300 million years ago.

The "census-taker" is the collector—usually myself—who must return to the coal field again and again,

*Continued on page 20.*

FIELD BRIEFS con't from p. 4

## New Exhibit: Imperial China: Photography 1846-1912

The Members' preview of this remarkable exhibit of vintage prints will be on September 28, 1:00 to 7:00 p.m., in Hall 27. The exhibit opens to the public on September 29. The 145 photos, made in China during the last sixty-odd years of the Ch'ing dynasty, have been lent from public and private collections in England and the United States, and most have not been previously exhibited or published.

The period covered by the exhibition was one of turmoil and change in China and much of this state of confusion is reflected in the images that are included. Such objects as panoramas showing the fall of the Taku Forts to the Anglo-French North China expeditionary force in 1860, studies of the Dowager Empress with her entourage, and views of the Old Summer Palace in Peking before it was burned, suggest something of the changes that would soon bring about the end of Imperial China.

Photography in the nineteenth century was a demanding, cumbersome process and, in China, the conditions under which the photographers worked were especially difficult and often dangerous. Despite this, a large number of photographers were able to travel through China with some freedom and they assiduously recorded historic events, monuments, the landscape, and the activities of the people. Views of street scenes, mandarins, shopkeepers, and panoramas of Hong Kong harbor and Macao during the height of the China trade are all to be seen here.

The exhibition, closing November 12, is jointly organized by the American Federation of Arts and Asia House Gallery.

Courtesy Asia House Gallery

Courtesy Asia House Gallery

Above: *The Chinese Dowager Empress, Tz'u Hsi (1835-1908) shown with attendant near the end of her reign.* Below: *Shop in Hong Kong, 1868-72. (Details)*

◄ *Representative Mazon Creek fossils, clockwise from top right: marine shrimp, cephalopod, hydra, jellyfish.*

each time loading the car with sackfuls of concretions, these to be taken back to the Museum for processing, examination, and storage. On a typical collecting day, last March, I found myself searching for abandoned mine dumps near Coal City, one of the towns in the Mazon Creek area. It was a bleak, gray morning, and underfoot there was snow and mud. But I knew that before the day was over my car would be loaded with new specimens. With a little luck I might even encounter a species new to science or in some other way remarkable. Every collecting day began with this feeling of excitement and anticipation.

I scanned the horizon, peered down the town's side streets, and scouted behind buildings for the piles of typically gray waste rock from the mines. There were several on my right, but these I had sampled on a previous visit. A quarter mile to the south, behind some sheds, I spotted several other piles. The next step was to secure permission to enter the property and do my collecting. At a nearby farmhouse I was told that the land with the rock piles was someone else's property. The farmhouse I was then directed to produced nothing but an unfriendly dog. I had no other choice, for now at least, to forget about collecting here. Further south, toward Braceville, I came across more dumps. After getting clearance from the owner I was finally able to set to work gathering specimens.

At this point, collectors typically gather up whole concretions, and carry them to a so-called "anvil," or flat rock, where they break them open. For census work, however, this procedure is too time-consuming as well as incompatible with efficient census-taking procedures. Therefore, I collected broken concretions that revealed fossils as well as whole concretions—these to be taken directly to my car. Later, at the Museum, they would be split open and their contents examined.

On this particular day I lucked out. I had been picking for about an hour and had nearly a full load to haul back to the car. Although fossils were plentiful here, they were unspectacular; most were "blobs" (possible jellyfish), clams, and plants. Then, suddenly, I found myself holding a "Tully monster" (*Tullimonstrum*), a peculiar wormlike animal that showed its original color banding. Excited, I stashed it in my shoulder bag. Lifting the bag, I saw under it a fossil egg case of *Paleoexyris*, a sharklike fish. At that moment my back pack toppled over; out fell a concretion, which broke open; inside was a rare shrimp!

The weather had turned colder and a sleet storm had begun, but none of this mattered to me; the day had already been one of singular success. It was this same feeling of reward that had brought other Mazon Creek collectors back there time and time again; and in another day or so—sleet, snow, or otherwise—I knew I would be back. □

Gordon C. Baird

*The result of 15 minutes' collecting at Pit 11: whole concretions which must now be split open to reveal their contents—perhaps a leaf, perhaps a shrimp, perhaps a species new to science.*

*Eugene Richardson, curator of fossil invertebrates, lecturing on Mazon Creek. The map is of Pit 11, one of the most productive sites in the area.*

# MAZON CREEK STUDIES

## *the first 120 years*

BY MATTHEW H. NITECKI

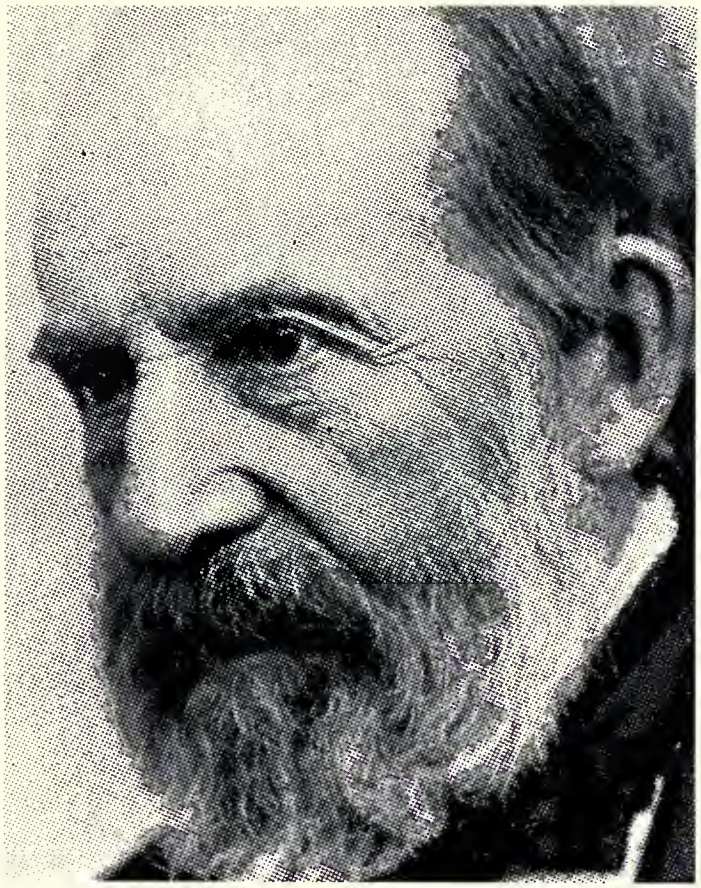
THE STUDY OF MAZON CREEK FOSSILS had its beginning in the mid-1800s, when the area came to the attention of geologists James Dwight Dana, Leo Lesquereux, and Edward Drinker Cope. Local farmers and townspeople, however, were the first to collect the curious, fossil-bearing concretions. Natural exposures along the creek and at mining sites that first appeared near Braidwood (about 1855) and Coal City (about 1858) produced these first specimens. Before long, local collectors, notably Joseph Even, S. S. Strong, and J. C. Carr loaned their concretions to Illinois State Geologist Amos H. Worthen and to Lesquereux.

When Dana published on two fossil insects from Mazon Creek in 1864, the locality immediately drew the interest of other American paleontologists. His brief paper describes an almost complete body and a wing fragment, both belonging to insects of extinct orders. Insects are relatively rare among Mazon Creek fossils, so it is remarkable that they were the first to be described.

Worthen was among the first to recognize that the Mazon Creek beds were out of the ordinary. Between 1865 and 1890 he and Fielding B. Meek published seven papers that

---

*Matthew Nitecki is curator of fossil invertebrates. He served recently as chairman of the Paleontological Society, north-central section, and was a convener of the Paleontological Society's symposium on Mazon Creek fossils, held May 1 at Ann Arbor, Mich.; 21 papers on Mazon Creek were presented at the symposium, 12 of which were by Field Museum staff or research associates. The papers are to be published shortly by Academic Press, New York.*



*Leo Lesquereux (1806-89) was the first paleobotanist to make an intensive study of Mazon Creek fossil plants.*

described and classified Mazon Creek fossils, these appearing in the volumes of the Geological Survey of Illinois and in the *Proceedings* of the Academy of Natural Sciences in Philadelphia.

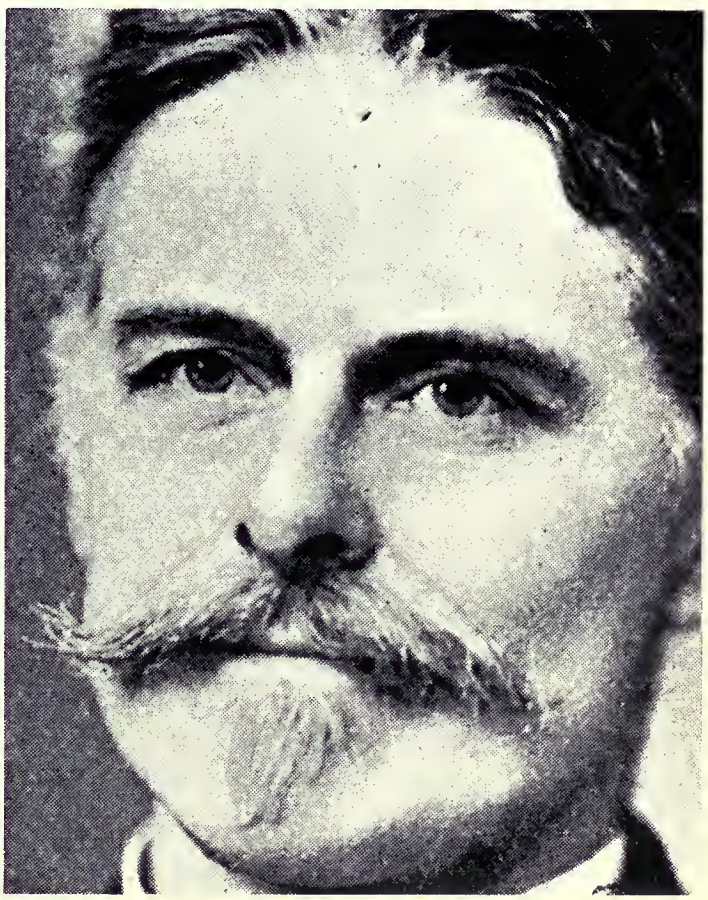
Volume II of the State Geological Survey (1866) was devoted in part to the Mazon Creek biota. In it, Joseph S. Newberry and Worthen described a fish, Cope an amphibian, Meek and Worthen several invertebrates, and Lesquereux 11 new species of plants.

Almost singlehandedly, Lesquereux established the discipline of paleobotany in this country, and by 1880 he had described over 1,300 species of fossil plants, most of which he collected himself. Lesquereux is best known for his studies dealing with floras of the Pennsylvanian, Cretaceous, and Tertiary periods and with mosses and prairies; but his work on the Mazon Creek flora was as rigorous as his other writings. By 1866 Lesquereux had described 71 species of fossil plants from Mazon Creek, represented by 614 specimens. In 1870 the number of species was 180 and the specimens were in the thousands.

From 1865 to 1895 Samuel H. Scudder, of Harvard University, published 32 taxonomic papers on Mazon Creek fossils, largely under the imprint of the Boston Society of Natural History. From 1908 to 1916 Roy Moodie, in a series of papers, described 10 species of amphibians, including a history of their discovery. Seemingly carried away by his enthusiasm, Moodie described more species than actually exist, since he confused differences of preservation with anatomical differences. From 1906 to 1920 Anton Handlirsch, of Vienna's Royal Imperial Museum, described 77 species of insects from the Mazon Creek area, assigning some of them to five new extinct orders. Other important papers published since 1902 on taxonomy, systematics, anatomy, evolution, and phylogeny of Mazon Creek animals are by Alexander Petrunkevitch (arachnids—spiders and their allies), Frank M. Carpenter (insects), Charles R. Eastman and T. S. Westoll (fishes), D. M. S. Watson (amphibians), and Harold K. Brooks (crustaceans).

Later study of fossil plants from Mazon Creek has followed the path of Lesquereux. Adolph Noé, of the University of Chicago, published a popular paper (1925) and Raymond Janssen popularized the Mazon Creek leaves and stems in a handbook (1939); in 1940 he revised some of Lesquereux's work. George Langford, influenced by Noé and Janssen, and relying heavily on the work of early European investigators, also published two popular volumes for the general public. Finally William Darrah, of Gettysburg College, presented a

*Edward Drinker Cope (1840-97), distinguished American paleontologist, early recognized the wealth of fossil treasures at Mazon Creek.*



*George Langford (1876-1964), paleobotanist and Field Museum staff member 1947-62.*

history of the Mazon Creek floristic studies and collections which included the number of species present, correlation with other Coal Age floras, a discussion of the environment and microenvironment, and a discussion of anatomy, with a description of megaspores and gametophytes (1969). The work continues today with Hermann Pfefferkorn of the University of Pennsylvania and with Tom Phillips and Russell Peppers of the Illinois Geological Survey.

Field Museum has the finest collection of Mazon Creek fossils in existence. It first became important through the work of Langford, who joined the Museum staff in 1947 and who collected and studied the fossil plants until his retirement in 1962 at the age of 86. (For further discussion of Langford's work see "George Langford, 1876-1964," by Eugene Richardson, in the February, 1976, *Bulletin*.) Noé's collection of Mazon Creek plants, deposited at the Museum by the University of Chicago, added to this already large floral collection. At that time the Museum's collection of the Mazon Creek biota was about 95 percent plants, which reflected the proportions preserved in collecting areas around Mazon Creek and the strip mines.

◄*Scanning electron photomicrograph of sea cucumber sclerites. Enlarged about 1,500 times. Specimen from Pit 11.*

Richardson, who joined the Museum's curatorial staff in 1946, almost immediately altered the character of the Mazon Creek collections. He began publishing on the Mazon Creek fauna in 1956, with a study of insects. The discovery of a new collecting site, Pit 11 (operated from 1945 to 1974 by the Peabody Coal Company near Essex), led to a quantum advance in the Mazon Creek studies. Here, and in the adjoining MacElvane Pit, fossil animals were as numerous as plants. It is this site which led Richardson to the significant observation that the biota could be assigned to three distinct groups: the Mazon Creek flora, the nonmarine (freshwater) Braidwood fauna, and the new marine Essex fauna.

Pit 11 has become as illustrious as the Mazon Creek locality itself, yielding a most unusual and extensive marine fauna. The remarkable preservation at the former differs from all previous Mazon Creek collections in that it includes soft-bodied animals not otherwise represented in the fossil record. The most celebrated is the "Tully monster" (*Tullimonstrum gregarium*), named for its discoverer, Francis J. Tully, and formally described by Richardson in 1966. (For more on this subject see "The Tully Monster," by Eugene Richardson, in the July, 1966, *Bulletin*.)

The research effort of Richardson and his colleagues

Herdina mirificus, *Mazon Creek fossil insect discovered by (and named for) Jerry Herdina (1905-1974). Shortly before his death, Herdina gave Field Museum his collection of more than 14,000 fossil specimens, nearly all from Mazon Creek.*

has been threefold: a description of the Mazon Creek fauna, a determination of their phylogenetic and paleoecological significance, and an investigation of the complex processes by which concretions are formed. The contributions of the late Ralph G. Johnson, of the University of Chicago, and of Frederick G. Schram, of San Diego Museum of Natural History, have also been important in the study of this fauna. Johnson's main work was on ecological community structure and paleoecology; Schram has contributed numerous detailed descriptions of crustaceans and other invertebrates.

Richardson invited the cooperation of specialists in various invertebrate and vertebrate groups and with Johnson assigned the study of some of the fauna to graduate students at the University of Chicago. As a result, more than 50 papers have appeared in about 20 journals; about half of these papers have been published in *Fieldiana: Geology* as part of a continuing study of the Mazon Creek fauna coordinated by Field Museum.

Another significant aspect of Richardson's work has been the development of a working relationship with a large number of amateur collectors, thereby giving the Museum access to thousands of specimens, including many rare and unique forms not represented in any public collection. Thus, more than 80 species have been described by Field Museum scientists and research associates. Additional forms currently awaiting formal description include cartilaginous fishes, insects, polychaetes, pelecypods, and coprolites.

Today, thanks in large part to the work of Richardson and his associates, Mazon Creek has become one of the most important fossil regions on the face of the earth. It is entirely fitting that Field Museum scientists have been the leading force in studies of the region. □

# *September & October at Field Museum*

*(September 15 through October 15)*

### New Exhibits

**Lake Michigan: An Endangered Natural Heritage?** Field Museum's newly opened mini-exhibit allows a close-up view of Lake Michigan ecology and asks 20th-century man to function with a concerned eye to the future. Otherwise, this rich, aquatic environment will be irrevocably altered in a hundred years' time. Second floor South Lounge.

**Cash, Cannon, and Cowrie Shells: The Nonmodern Moneys of the World.** Opened August 15. A fascinating collection that contains over 80 varieties of money used by ancient cultures of the world. It explores the origins, values, and meaning of nonmodern money in terms of buying power for these past civilizations. The accompanying text evaluates the worth of each form of money by considering food prices in ancient times. Four general categories of nonmodern moneys will be displayed: metal coinage, uncoined metal, shell money, and a miscellaneous group which includes currencies made of food, fur, fiber glass, teeth, and stone. No closing date. Between Halls K and L, ground floor.

*Facsimile of gold oban, a Japanese coin of the 16th century; length 15.6 cm. This and other examples of primitive money will be on view between Halls K and L, ground floor, beginning August 15.*

**Imperial China: Photography 1846-1912.** A rare collection of 145 photographs exemplifies the kind of pictures that gave the 19th-century Western world its first look at the "real China." These vintage pictures, captured by pioneer photographers, document the daily life of ordinary Chinese people—their chores, celebrations, and physical environment. Hall 27. September 29 through November 12. (Members' preview Sept. 28.)

### Continuing Exhibits

**Field Museum Gamelan.** Field Museum's 19th-century Javanese gamelan, an ensemble of 24 fine bronze and wood musical instruments, has been completely restored for exhibition. It is the oldest and perhaps finest gamelan outside Indonesia. Hall K, ground floor.

**Pawnee Earth Lodge.** This exhibit, in Hall 5, is a traditionally made Pawnee earth lodge—the home and ceremonial center of Pawnee Indians as it existed in the mid-1800s. Daily programs provide the opportunity to learn about Pawnee culture. Public program hours: Monday through Friday, 1:15 p.m.; weekends, 11 a.m. and 1:15 p.m. Tickets may be obtained 15 minutes prior to the program at the North Information Booth. Programs limited to 30 people.

**The Place for Wonder.** This gallery provides a place to handle, sort, and compare the artifacts and specimens. Weekdays, 1 p.m. to 3 p.m.; weekends, 10 a.m. to noon and 1 p.m. to 3 p.m. Ground floor, near elevator.

### New Programs

**World Music Program for Children.** With Ira Kersh. For members' children. Series I begins September 9. Introduces several cultures from around the world, including Tibetan, Thai, Indonesian, and Southwest Indian. For further information, see page 14.

**Environmental Field Trips.** Begin September 9. Consult Kroc Field Trip Brochure for further details.

*Calendar continued on back cover*

# *September and October at Field Museum*

*(CALENDAR continued from inside back cover)*

### New Programs

**Bugaku.** First in a series of 3 programs in the International Festival of Music and Dance sponsored by Field Museum. *Bugaku*, the 1,000-year-old ceremonial dance of the Japanese Imperial Household will be performed September 16 by 17 musicians and dancers of the Osaka Garyo-Kai at Field Museum. The performers, wearing fierce masks and ornate costumes depicting the dress of ancient Japanese warriors, will dance to traditional music known as *Gagaku*, an ensemble of gongs, drums, flutes, and string instruments. Series admission (3 programs): members, $12.00; nonmembers, $15.00. Single program admission: members, $5.00, nonmembers, $6.00. Members' dinner: $7.50 each.

**Fall Journey for Children:** "Journey into the World of Money." September 1 through December 31. This journey explains what today's dollar would be exchanged for in an ancient Aztec or Chinese city. The tour also shows what kind of offering a visitor would bring to pay homage to an ancient African king. Free *Journey* pamphlet at the Information Booth, main floor. Bring pen or pencil.

**The Stationary Ark.** An illustrated film lecture by Gerald Durrell, noted British conservationist, author, and filmmaker. September 23 (repeat program September 24, 2:30 p.m. in case of sell-out) at 2:00 p.m., James Simpson Theatre. Durrell's presentation on breeding animals in captivity at the Jersey Wildlife Preservation Trust is geared to children as well as to adults. Members: $1.50; nonmembers: $3.00. For more information and coupon, see page 4.

**Ayer Film/Lecture Series.** Begins October 7. Each Saturday, at 2:30 p.m., sit back and enjoy a ninety-minute adventure in a remote or familiar area of the world. These beautifully produced films are personally narrated by their film makers. Reserved seating is available for members and their families. Doors open at 1:45 p.m. Simpson Theatre, ground floor west.

October 7 — *Turkey*
by Willis Butler

October 14 — *Poland*
by Sherilyn and Matthew Mentes

### Continuing Programs

**Friend or Foe? The Natural History Game.** Recently opened. Field Museum's popular *Anthropology Game* has now been expanded to include botany, geology, and zoology. The object here is to determine which one of a pair of apparently similar specimens is harmful and which is not. Some of the more dangerous playing elements include: a vampire bat, a headhunter's axe, a poisonous mineral, and a deadly mushroom. Ground floor; no closing date.

**On Your Own at Field Museum.** Self-guided tour booklets, adult- and family-oriented, are available for 25c each at the entrance to the Museum Shop, main floor north.

**Weekend Discovery Programs.** Guided tours, demonstrations, and participatory activities. Every Saturday and Sunday, 10 a.m. to 3 p.m.

**Audio Information System.** Uniguide audio receivers and maps available for $1.25 per person, $3.75 for a family of up to five at the entrance to the Museum Shop, main floor north.

### September and October Hours

**The Museum** opens daily at 9 a.m. and closes at 5 p.m. every day except Friday. On Fridays the Museum remains open throughout the year until 9 p.m.

**The Museum Library** is open weekdays 9 a.m. to 4 p.m. Obtain a pass at reception desk, main floor.

Museum telephone: (312) 922-9410

October
1978

Field Museum of Natural History Bulletin

# Field Museum of Natural History Bulletin

October, 1978
Vol. 49, No. 9

*Editor/Designer:* **David M. Walsten**
*Production:* **Oscar Anderson**
*Calendar:* **Mary Cassai**
*Staff photographer:* **Ron Testa**



## Field Museum of Natural History
Founded 1893

*President and Director:* **E. Leland Webber**

BOARD OF TRUSTEES

William G. Swartchild, Jr., *chairman*
Mrs. T. Stanton Armour
Goerge R. Baker
Robert O. Bass
Gordon Bent
Harry O. Bercher
Bowen Blair
Stanton R. Cook
O. C. Davis
William R. Dickinson, Jr.
Thomas E. Donnelley II
Marshall Field
Nicholas Galitzine
Paul W. Goodrich
Hugo J. Melvoin
William H. Mitchell
Charles F. Murphy, Jr.
James J. O'Connor
James H. Ransom
John S. Runnells
William L. Searle
Edward Byron Smith
Robert H. Strotz
John W. Sullivan
Mrs. Edward F. Swift
Edward R. Telling
Mrs. Theodore D. Tieken
E. Leland Webber
Julian B. Wilkins
Blaine J. Yarrington

LIFE TRUSTEES

William McCormick Blair
Joseph N. Field
Clifford C. Gregg
Samuel Insull, Jr.
William V. Kahler
Remick McDowell
James L. Palmer
John T. Pirie, Jr.
Donald Richards
John M. Simpson
J. Howard Wood



*Field Museum of Natural History Bulletin* is published monthly, except combined July/August issue, by Field Museum of Natural History, Roosevelt Road at Lake Shore Drive, Chicago, Il. 60605. Subscriptions: $6 a year; $3 a year for schools. Museum membership includes *Bulletin* subscription. Opinions expressed by authors are their own and do not necessarily reflect the policy of Field Museum. Unsolicited manuscripts are welcome. Postmaster: Please send form 3579 to Field Museum of Natural History, Roosevelt Road at Lake Shore Drive, Chicago Il. 60605. ISSN: 0015-0703. Second class postage paid at Chicago, Il.


## CONTENTS


3 **Field Briefs**

4 **Our Environment**

6 **The Terror Bird**
*By Larry G. Marshall, visiting curator of paleontology*

16 **Ancona School Comes to Field Museum**
*By Carol Burch-Brown and Mary Hynes-Berry*

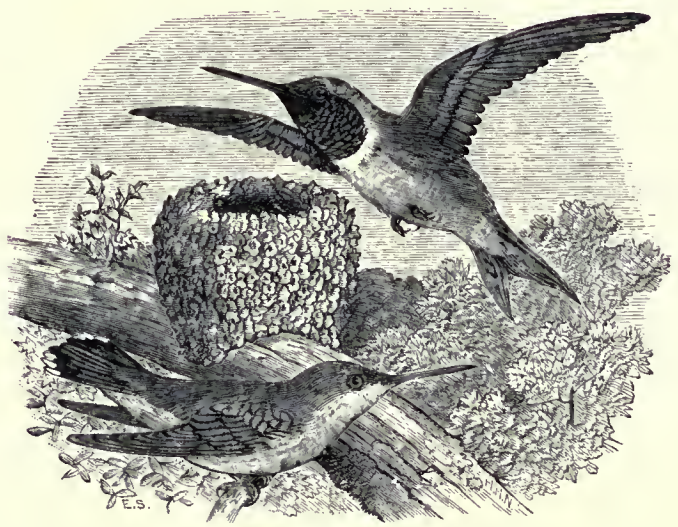
26 **Edward E. Ayer Film Lecture Series**

27 **October and November at Field Museum**
Calendar of coming events


## COVER

October pond. Photo by John Kolar.


*The editor gratefully acknowledges the assistance of Field Museum Volunteer Hermann Bowersox in the editorial preparation of this issue.*

# FIELD BRIEFS

### Staff Notes

**Betty L. Weaver** is the new Museum Shop manager. Most recently, Mrs. Weaver served as business manager of the Kalamazoo Institute of Arts. A native of Flint, Michigan, she holds a B.A. from Central Michigan University.

**Joseph Sulek** has been named chief accountant. A native Chicagoan, Sulek received his B.A. in economics from Loyola University (Chicago) and is a certified public accountant. His previous affiliation was with Arthur Young & Company.

**Edward Bedno** has joined Field Museum as chairman of the Department of Exhibition. Most recently, Bedno was chairman of the Department of Communication Arts and Design at Richmond Commonwealth University, Richmond, Va. Before that he was on the faculty of the Illinois Institute of Technology Institute of Design, in Chicago. A native of Chicago, Bedno attended Chicago public schools. He holds a B.F.A. from the Art Institute of Chicago and an M.S. from the Illinois Institute of Technology.

**Michael J. Flynn** has been named to the new post of manager of Field Museum of Natural History Tours, within the Department of Planning and Development. Before coming to the Museum, Flynn operated a retail travel agency with several offices in the Chicago area.

### Egypt Tours for Members

Remember the summer of '77 and the excitement of the Tutankhamun Exhibition at Field Museum? A second thrill can now be yours: visiting the land where the boy-king ruled over 3,300 years ago, via Field Museum's tours to Egypt. Highlighting each of the two tours will be a descent into Tutankhamun's tomb—the single greatest find in archaeologically rich Egypt.

Our 19-day tour will also expose you to a culture that continues today much as it did centuries ago. Your guide will be a professional Egyptologist—Dr. David Silverman or Dr. James P. Allen—who is intimately familiar with the history, art, and culture of ancient Egypt.

The itinerary includes Beni Hassan, and Ashmunein—important for their remains of the Middle Kingdom, Luxor and Karnak Temples, the West Bank with its Colossi of Memnon, the Ramesseum, the Village of Deir el Medineh where some of the finest New Kingdom tomb paintings are found, the Valley of the Queens and that of the Kings, the Tombs of the Nobles including Menna, Ramose, and Sennefer, Dendereh, with its Ptolemaic and Roman Temple complex, Abydos, Esna and its temple of the ram-headed god Khnum, Kom Ombo and Aswan. A sound-and-light performance at Karnak is on the agenda.

There are two departures: January 4 and February 15. The maximum size for each group will be 24. Each tour features a 5-day cruise on the Nile River aboard the deluxe *Isis* or *Osiris* diesel cruisers as well as deluxe hotel accommodations (except one night in Minia where the best Egyptian hotel will be used). For further information and a detailed itinerary, please write or call Michael J. Flynn, Field Museum Tours, Roosevelt Road at Lake Shore Drive, Chicago, Ill. 60605. Phone (922-9410).

*The Temple of Amon at Karnak, Egypt*

Courtesy of the Oriental Institute, University of Chicago

# OUR ENVIRONMENT

### Endangered Status Proposed for Illinois Mud Turtle

Listing the Illinois mud turtle (*Kinosternon flavescens sponneri*) as an endangered species and identifying its critical habitat was proposed by the U.S. Fish and Wildlife Service in the July 7, 1978, *Federal Register*. Threats to the turtle's survival include intense habitat alteration and collecting by amateur turtle enthusiasts. There are at least three populations of the species in Illinois and Iowa.

Endangered means that a species is in danger of extinction throughout all or a significant portion of its range. Listing the turtle as endangered and identifying its critical habitat would give it the protection of the Endangered Species Act of 1973. The act prohibits any federal agency from authorizing, funding, or taking any action that would threaten the continued existence or adversely affect the critical habitat of a listed species. Critical habitat designation, however, does not affect actions by private landowners, states, or local governments.

### Thirty "Endangered Species" Candidates Not in Trouble After All

Thirty native plants and animals which have been under review as candidates for the endangered or threatened species lists are being removed from further consideration, primarily because evidence received from the public indicates they are more common than previously thought. The species and subspecies occur throughout the nation and were originally placed under review at various times over the last four years. They include 3 plants, 2 freshwater sponges, 3 snails, 18 butterflies, a turtle, a salamander, and 2 snakes.

During the last four years, the Fish and Wildlife Service has published a number of notices of review indicating that there were sufficient data then available to warrant a review of various animals and plants to determine whether they should be listed. During this period, two plants were proposed as endangered which are no longer considered as candidates for listing. These public notices requested comments and data from knowledgeable persons about the biological status and range of these species. On the basis of data submitted from individuals, universities, states, and organizations, these species have been found not to warrant further consideration as candidates for listing.

The 30 species removed from the list are the following: **plants:** *bird's eye primrose* (north U.S. and Canada), *Alaskan rein orchid* (AK), *unnamed species of bladderpod* (NM, TX); **freshwater sponges:** *muscular sponge* (MI), *spongy sponge* (SC); **snails:** *dented peninsula snail* (CA), *Nicklin's peninsula snail* (CA), *Tryon's snail* (CA); **butterflies:** *Catalina orange-tip* (CA), *Andrews marble* (CA), *Dina's yellow* (FL), *Mitchell's satyr* (MI, IN, NJ), *Mead's satyr* (CO), *chryxus arctic* (WA), *mountain silverspot* (AZ, NM), *blue silverspot* (AZ), *unsilvered fritillary* (CA), *Clemence's fritillary* (CA), *Tehachapi mountain silverspot* (CA), *minute checkerspot* (TX), *Doudoroff's elfin* (CA), *Wind's elfin* (CA), *bog elfin* (ME, NH), *Hessel's hairstreak* (CT, DE, MD, NJ, NY, NC, VA); *Hawaiian hairstreak* (HI), *clouded tailed copper* (CA); **turtles:** *red-bellied turtle* (NC, VA, MD, DE, NJ); **amphibians:** *Siskiyou mountain salamander* (CA, OR); **reptiles:** *desert kingsnake* (AZ, NM, TX, OK), *gray-banded kingsnake* (TX).

### Ten Moths and Butterflies Proposed for Endangered or Threatened Status

Two species of moths and eight species of butterflies whose habitats have been modified by housing developments, urbanization, land clearing, agriculture, grazing, or the absence of fires have been proposed for endangered or threatened status by the U.S. Fish and Wildlife Service. The proposal, published in the July 3, 1978 *Federal Register*, lists three species as endangered and seven as threatened. It also proposes critical habitat for eight of the species.

The species are all dependent upon highly specific kinds of habitat for their survival. And man is changing those habitats to meet his needs. For example, several species of butterflies depend upon lupine plants to provide seeds for their food. The seeds germinate after fires. When natural fires are prevented or quickly extinguished lupines are crowded out by brush.

Another example: the Dakota skipper butterfly is found in virgin prairieland. This species had originally occurred from southern Manitoba south through North Dakota, South Dakota, Minnesota, Iowa, and Illinois. Populations have been eliminated from Manitoba and Illinois, and the butterfly's occurrence in the remainder of its range is reduced. Conversion of virgin prairie to alternate human-related land uses is proceeding rapidly and includes agriculture, urbanization, quarry operations, highway construction, weed control operations, and inundation from dam construction.

The blue-black silverspot butterfly originally occurred in the Rio Grande Valley in southern Conejos County, Colorado, southward into New Mexico. The only known surviving colony is now reported near Tsaile Creek, Apache County, Arizona. Man's growing need for water is altering the habitat need for this species' continued existence. Human-related activities that have affected this species are farming and irrigation, construction of roads, haying, and grazing.

The species included in this proposal and the states in which they occur are:

- **San Francisco tree lupine moth**—(threatened, critical habitat proposed) California.
- *Kern primrose sphinx moth*—(threatened) California.
- *Dakota skipper butterfly*—(threatened, critical habitat proposed) Illinois, Iowa, Minnesota, North Dakota, and South Dakota.
- *Pawnee montane skipper butterfly*—(endangered, critical habitat proposed) Colorado.
- *Callippee silverspot butterfly*—(endangered, critical habitat proposed) California.
- *Great Basin silverspot butterfly*—(threatened, critical habitat proposed) Colorado and Utah.
- *Blue-black silverspot butterfly*—(threatened, critical habitat proposed) Arizona, Colorado, and New Mexico.
- *Oregon silverspot butterfly*—(threatened, critical habitat proposed) Oregon.
- *Karner blue butterfly*—(threatened, critical habitat proposed) Illinois, Indiana, Massachusetts, Michigan, Minnesota, New Hampshire, New York, Ohio, Pennsylvania, and Wisconsin.
- *Palos Verdes blue butterfly*—(endangered) California.

### Kirtland's Warbler Seen in Wisconsin

Two male Kirtland's warblers observed in early June seem to be prospering in central Wisconsin, according to the U.S. Fish and Wildlife Service. The bird, which has been listed as an endangered species since 1969, is known to nest only in the north-central portion of lower Michigan. Less than 500 are known to exist anywhere.

It has been several years since anyone has reported seeing the bird in Wisconsin. Only five previous sightings have been recorded. The Wisconsin sighting was made by an employee of the Wisconsin Department of Natural Resources while on reconaissance of potential habitat sites for the warbler. Nancy Tilghman, wildlife ecologist, made the find on her last visit to a potential warbler site. The sighting of the two male warblers was confirmed by Michigan experts who live-trapped one of the birds and discovered it was banded in Crawford County, Mich., in 1972.

This warbler's nesting requirements and unusual lifestyle have led to many problems for the bird. Its breeding habitat is tied to young jack pine stands where nests are concealed by heavy ground vegetation.

Wintering in the Bahamas, the Kirtland's warbler faces added risks during its long migration. Cowbirds also pose a unique threat to the Kirtland's warbler. Cowbirds lay their eggs in warbler nests and the young are hatched by parent warblers. Newly hatched Kirtland's warblers cannot compete with the cowbird fledglings.

In Michigan, a joint effort at cowbird control by the Department of Natural Resources, Audubon Society, Forest Service, and the Fish and Wildlife Service, is helping to reduce this loss. Cowbird control began in Michigan in 1972. No other birds or nests have been located at the Wisconsin site, but biologists speculate that one of the males has mated. Wildlife officials will consider the possibility of a land management program for Kirtland's warblers in Wisconsin if indications continue to be favorable.

### Bald Eagle Roosting Site Acquired by Condemnation

In an effort to preserve the core of the largest bald eagle roosting site in the lower 48 states, the U.S. Fish and Wildlife Service has acquired by condemnation 240 acres of privately owned timberland in Klamath County, Oregon, which is used nightly by about 300 eagles.

Logging on the area was to begin the morning of June 1 by a lumber company which had purchased the timber from a private landowner. On the afternoon of May 31 a declaration of taking with an order of immediate possession was filed by the U.S. attorney in the U.S. District Court in Portland. Negotiations to acquire the property had gone on for over two months. However, the service was unable to reach agreement upon price and had to move to condemnation in order to prevent the cutting of trees which would have destroyed the eagles' roost.

The mountainous area is covered with tall ponderosa pines, prime bald eagle roosting habitat. It is located about 15 miles southwest of Klamath Falls. The Fish and Wildlife Service appraised value of $200,000 for the land was deposited with the court at the time of the taking. The court will determine just compensation for the landowner at a later date. The declaration of taking established the area as the Bear Valley National Wildlife Refuge. Various statutes, including the Land and Water Conservation Act and the Endangered Species Act of 1973, provide the authority for such condemnation actions.

### Peregrines Pilfered

Life is tough enough just being an endangered species without additional pressure from human nest robbers. Peregrine falcons are under strict protection of the national endangered species act of 1973. Even so, an active nest near Morro Bay, California, has been robbed for the last ten years in a row. The nest is now under 24 hours' guard to prevent an eleventh recurrence of what has become an annual pilfering of the peregrine young.

The Morro Coast Chapter of the Audubon Society has persuaded the Morro Bay City Council to designate the peregrine falcon as the city's official bird and has been instrumental in guarding the nest this year against further theft.

### Tabasco Sauce for Coyotes

The University of Wyoming, aided by a $160,000 federal grant from the Agricultural Research Service, is developing synthetic tabasco to be sprayed on sheep to discourage coyote attacks. Tests have indicated that coyotes do not like seasoned meat and will pursue other game if they discover mutton is hot or bitter tasting. Project scientists predict that the coyotes will still attempt to bite the sheep instead of merely smelling them. If they taste enough of the tabasco, the coyotes should run to find water or rub their muzzles in the dirt to soothe the irritation.

*Continued on p. 22*

# THE TERROR BIRD

BY LARRY G. MARSHALL

Toward the end of the last century the scientific world was startled by a report from Argentina of newly discovered fossil remains of gigantic flesh-eating birds unlike anything previously known. Some of these ancient birds were reportedly taller than a man, had a skull longer than a horse's, and were said to be capable of killing and eating just about anything they wanted. These, the phororhacoids, or "terror birds," were a paleontological trophy, and Field Museum paleontologist Elmer S. Riggs was determined to "bag" one for his museum.

## THE QUEST

To this end, he led the Second Marshall Field Paleontological Expedition to Argentina in late April, 1926. In addition to Riggs, the field crew included Robert C. Thorne of Vernal, Utah, as camp hand and collector and Rudolf Stahlecker, a young German, as geologist. Their destination was the fossil beds of Pliocene age (*ca* 5-7 million years old) in the province of Catamarca in northwestern Argentina— home of the terror bird.

The group's first stop was the railway terminus at Andalgalá, where they were greeted by a Colonel Wieser. The colonel, who had known Riggs for several years, accepted Riggs's invitation to assist the present expedition. Two native Argentines, Srs. Juan and Felipe Mendez, were hired as local collectors; both were to prove themselves highly useful in the months to come.

The rainy season in Catamarca extends from December to April, and the months immediately following are the most favorable for collecting. The fossils are then newly washed clean and most easily discovered. Feed for pack animals, too, is most abundant after the rains. May, then, was a most propitious time for the expedition to get under way.

Two saddle horses and six pack mules were hired to convey the men and their gear from Andalgalá over a mountain pass to the village of San José in the Valle de Santa María —a distance of some 120 miles requiring four days' travel. From there, camp was moved to the little Indian village of Chiquimil, or Entre Ríos, a few miles southeast of San José on the east side of the valley. The fossil-bearing beds in this area —already well known to paleontologists—consist of a large series of massive sands and hardened clays. Remains of mammals and of terror birds were locally abundant, expecially on a small hill known as Loma Rica ("Rich Hill"), a name given by previous collectors because of the site's abundant fossils.

By the end of July, the expedition had prospected and collected for a distance of more than 50 miles along the east side of the Valle de Santa María. By this time the area's fossil beds were all but exhausted, and it was decided to move camp. But where to go next?

---

Larry G. Marshall is visiting curator of paleontology.

*The terror bird* Andalgalornis *attacking the horselike* Diadaphorus, *as conceived by artist-paleontologist Bonnie Dalzell.*

Copyright by Bonnie Dalzell.
Reproduced courtesy of the artist.

Wieser reported that he had seen bones similar to those just found while excavating Indian graves near the village of Puerta de Corral Quemado, some 100 miles southwest of San José. This corroborated another report received two months earlier. Since fossil mammals were not yet known from that area, Riggs was eager to investigate. So during the second week of August the pack animals were loaded, the accumulated fossils were stored at San José, and the expedition moved to Puerta de Corral Quemado. Residence was established there in a new adobe building on the property of a provincial senator. It was now midwinter and the party had, in fact, encounterd a snowstorm as they traveled; so the new, relatively comfortable shelter was most appreciated. But their comfort was short lived, for soon the building became infested with insects and some members of the party chose to sleep in tents.

Collecting in the Corral Quemado area was carried out from mid-August through mid-November. Most finds were

*Camp at Chiquimil, in the Río Santa María Valley, Catamarca Province*

made from along the Río Corral Quemado and its immediate tributaries, although prospecting was done to the west of this area and some collections were made as far away as three miles southwest of Río Corral Quemado. More specimens were obtained from Corral Quemado, whose widely exposed beds had never been investigated, than from the Valle de Santa María, which had been prospected frequently. Summer began in November, and with it came the rains. The periodic showers interfered with collecting activities so work was discontinued.

The fossil collection was then packed and readied for transport to the railway depot at Andalgalá. The smaller boxes were conveyed by pack mules, the heavier ones by a horse cart, to the pueblo of Belén, some 40 miles south of Puerta de Corral Quemado. There, they were loaded into a truck and taken to Andalgalá.

The problem then arose of claiming the collection stored at San José and of getting it to Andalgalá. A landslide caused by heavy rains entirely blocked a section of road, rendering the route impassable. To compound the difficulties, wagon freighters refused to make the journey from San José to Belén because of a shortage of horse feed. The only alternative now was to use pack mules. The collections, however, had been packed in boxes too heavy for mules. So Thorne and the Mendez brothers went back to San José, where they unpacked the collections and reduced the boxes to smaller units, repacking them in weights that the mules could carry. Thus, the collection was conveyed from San José by mountain and desert trails to Andalgalá; from there, along with the Corral Quemado collection, it went by rail to Buenos Aires.

The men, too, proceeded to Buenos Aires, arriving in late December, 1926. Their search for the terror bird had been an exhausting enterprise, but one that was amply rewarding.

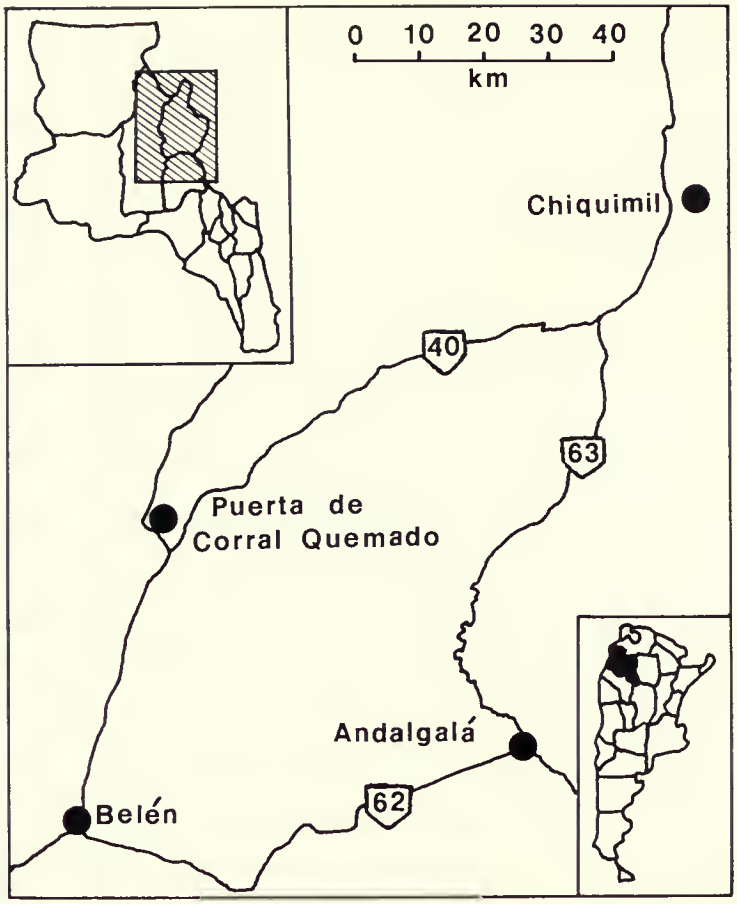
The expedition returned to Field Museum with several good specimens of terror birds. The nearly complete skull and skeleton collected by Riggs' party from near Chiquimil was a form completely new to science. In 1960 it was assigned its present scientific name, *Andalgalornis ferox*, jointly by Bryan Patterson, then a Field Museum curator, and by the Argentine paleontologist Jorge L. Kraglievich.* The skeleton is now on view in Hall 38. A lifelike restoration, based on this skeleton and created by Leon L. Pray, staff taxidermist from 1901 to 1947, may be seen in Hall 21.

**Andalgalornis feros* was formally described in "Sistematicos y Nomenclatura de las Aves Fororracoides del Plioceno Argentino," by Patterson and Kraglievich, which appeared in *Publicaciones de Museum Municipal de Ciencias Naturales y Tradicional de Mar del Plata*, Vol. 1, No. 1; July 15, 1960.

*Robert C. Thorne (left) and Felipe Mendez excavate skeleton of* Andalgalornis *at Chiquimil. Bird's skull is partially exposed.*

*The camp at Chiquimil. Left to right: German geologist Rudolf Stahlecker, camp hand Juan Mendez, leader Elmer S. Riggs, camp hands Robert C. Thorne and Felipe Mendez. Standing is unidentified camp hand.*

◄ *At Puerta de Corral Quemado, Robert C. Thorne uses rope ladder to reach fossils in cliff face.*




*Argentina, showing collecting sites*

## THE QUARRY*

*Andalgalornis*, about five feet high, is typical of the most spectacular group of flesh-eating birds that ever lived. Like all phororhacoids, it had greatly reduced wings, obviously useless for flight, but which were doubtless used for balance while running. Built for speed, *Andalgalornis* had a trim, narrow body and long, powerful legs—the characteristics of a fleet-footed runner. It may even have been as fast as an ostrich, which reportedly can outdistance a galloping horse in a straight run. Its large head, enormous hooked beak, powerful feet, and big curved claws testify eloquently to the flesh-eating habits of this creature. A bird of such size, ferocity, and speed was certainly a most formidable engine of destruction. *Andalgalornis* must have been a nightmarish terror to animal life of its day, and it was probably the most dangerous bird ever to have existed.

Three families of phororhacoids, assorted into medium, large, and gigantic size groups by mammalian standards,

**Much of the discussion in this section is excerpted or adapted from "Museum Restores Giant Fossil Bird that Terrorized Large Mammals," by Bryan Patterson,* Field Museum Bulletin, *March, 1941.*

*Ready to leave camp at Puerta de Corral Quemado*

*Camp at Puerta de Corral Quemado. Though invitingly new, the adobe building also attracted insects, and some of the men chose to sleep outside in tents.*

*Strikingly apparent here is the difference in skeletal structure between the fleet-footed, carnivorous terror bird* Andalgalornis *(left) and the ponderous, herbivorous* Emeus, *or moa, from New Zealand, also extinct. Both specimens are about five feet tall.*

are recognized. They are known to have ranged in South America from the early Oligocene (*ca* 35 million years ago) to the late Pliocene (*ca* 3 million years ago). The earliest forms are virtually as specialized as the latest, a fact indicating a long pre-Oligocene history, which is still entirely unknown. One form, *Titanis*, known from beds of late Pliocene age of Florida, immigrated to North America from South America across the Panamanian land bridge, which appeared at about that time.

Two of the families, Psilopteridae and Phororhacidae, appear in the early Oligocene and are well represented in the Pliocene. Psilopterids resembled the phororhacids rather closely in proportions and general skeletal structure, but they were relatively small—not more than three feet tall. Members of both families were lightly built and obviously swift runners; they were clearly the dominant cursorial, or running, carnivorous animals of their time. The third family, Brontornithidae, are known only from beds of early Oligocene through early Miocene (*ca* 20 million years ago) in age. They included giant ponderous forms with large massive beaks.

*Leon L. Pray (1882-1975), Field Museum artist and taxidermist from 1901 to 1947, puts finishing touches on life-size model of* Andalgalornis, *on exhibit in Hall 21.*

More heavily built and with relatively shorter lower leg bones than members of the other two families, they were cumbersome and undoubtedly slower afoot.

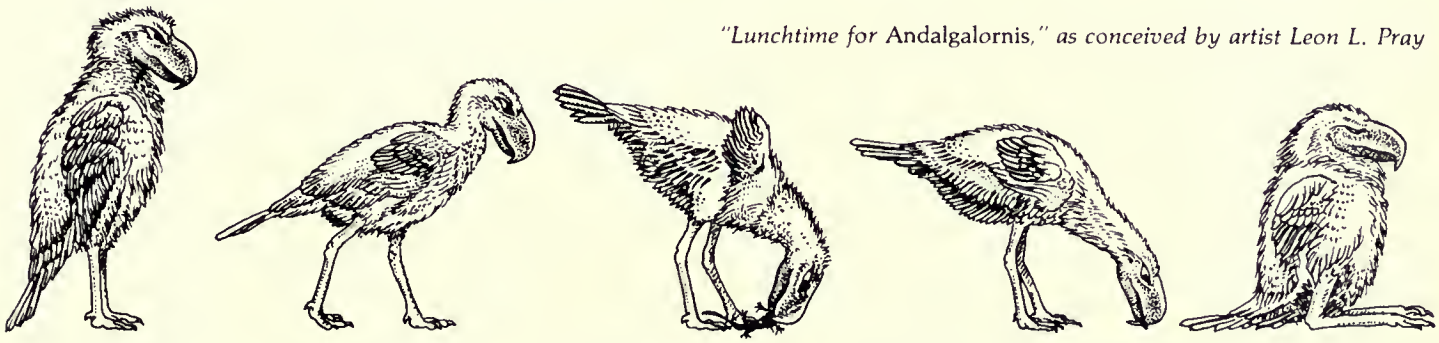
So large and so varied a group of flesh-eating birds were capable of preying on a wide variety of animals, from creatures the size of mice to the larger herbivorous mammals. Brontornithids may even have preyed to a large extent on the armored glyptodonts, which then and earlier were relatively small and thin-shelled.

It is most unusual that flesh-eating ground birds should have played such an important role in the economy of nature. A comparable situation does not exist anywhere in the world today, although terror birds of the families Diatrymatidae and Gastornithidae are known from the late Paleocene (*ca* 55 million years ago) to middle Eocene (*ca* 45 million years ago) of North America and Europe. A possible explanation for these unusual situations does exist:

The other large flesh-eating animals in South America during the reign of the terror birds were doglike and saber-tooth marsupials—distant relatives of the opossum. Many of these flesh-eating marsupials were strikingly similar but totally unrelated to dogs and cats, which had not yet made their appearance in South America. It is perhaps significant that coordinate with the diversification and taxonomic increase in phororhacoids between 35 million and 4 million years ago, there was a corresponding decrease in the large flesh-eating marsupials. The terror birds slowly replaced the flesh-eating marsupials until about 3 million years ago, when only the birds remained. For some unknown reason the marsupials failed to retain the status of "dominant flesh-eater" in South America, a failure which made possible the evolution of phororhacoids. But the mammals did win out in the end. With the appearance about 3 million years ago of the Panamanian land bridge, which connected the continents of the northern and southern hemispheres, dogs and cats immigrated to South America from North America, and extinction of the terror birds followed shortly thereafter. This suggests that dogs and cats were the better competitors. In North America the terror birds coexisted with creodonts—primitive placental carnivores—but disappeared with the appearance of true carnivores in the late Eocene. The terror birds thus evolved in the absence of true placental carnivores, which have shown themselves to be better competitors; the marsupials and creodonts were, in essence and relative to the terror birds, second-rate.

It is perhaps surprising that despite the flesh-eating

*"Lunchtime for* Andalgalornis," *as conceived by artist Leon L. Pray*



Thinking about lunch | On the prowl | Shredding the victim | Good to the last morsel | Gorged

*Paleontologist Bryan Patterson, formerly at Field Museum, who co-authored 1960 paper formally naming* Andalgalornis.

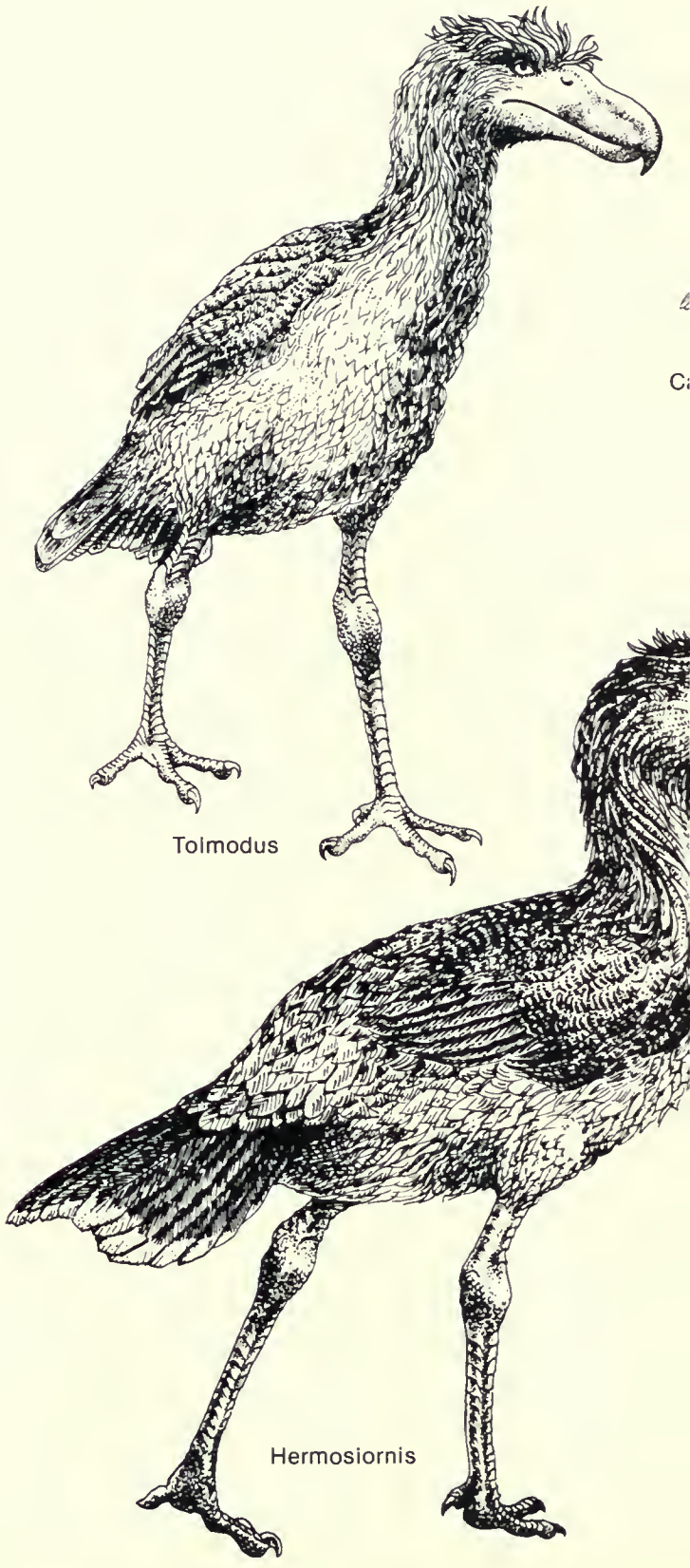
habits of phororhacoids they are related neither to hawks, eagles, falcons, nor to owls. Following their discovery around 1890, there was considerable controversy among paleontologists over their true affinity. The dispute was settled in 1899 by C. W. Andrews of the British Museum as a result of exhaustive investigations based on excellent specimens of the early Miocene genus *Phororhacos*. Andrews came to the conclusion that phororhacoids were more closely related to cariamas, found today in Argentina and Brazil, than to any other bird group, living or extinct. Research carried out by Patterson, then at Field Museum, on the splended specimens collected by Riggs, has substantiated this conclusion. Cariamas and phororhacoids are classified as members of the order Gruiformes, which includes cranes, rails, and their relatives.

Cariamas are long-legged, long-necked birds which stand about two feet tall. Capable of running as fast as 25 miles per hour, they resort to flight only when necessary. Their food consists largely of insects, birds, reptiles, and small mammals. They will, however, attack larger game if opportunity permits, and have been known to raise havoc among domestic fowl. Oddly enough, they can be domesticated, and in this condition are reported to act as guardians of the poultry they might otherwise prey upon. Cariamas do not strike with their feet as phororhacoids presumably did, but they do have the habit of seizing prey in their beaks and hurling it to the ground with great force. In cariamas the inner claw of each foot is long, sharp, and deeply curved—apparently a safety device for holding prey to the ground. They roost and nest in bushes and low trees, activities which their phororhacoid relatives could not do.

With its tendency toward ground-dwelling habits, its insectivorous-carnivorous diet, and its weak powers of flight, the cariama is an almost ideal structural ancestor for the phororhacoids, in which such features and tendencies were carried to extreme. It is intriguing to speculate that if all carnivorous mammals were to vanish from South America, cariamids would again give rise to a group of flesh-eating ground birds whose members might well develop into forms strikingly similar to *Andalgalornis* and its bygone allies. □

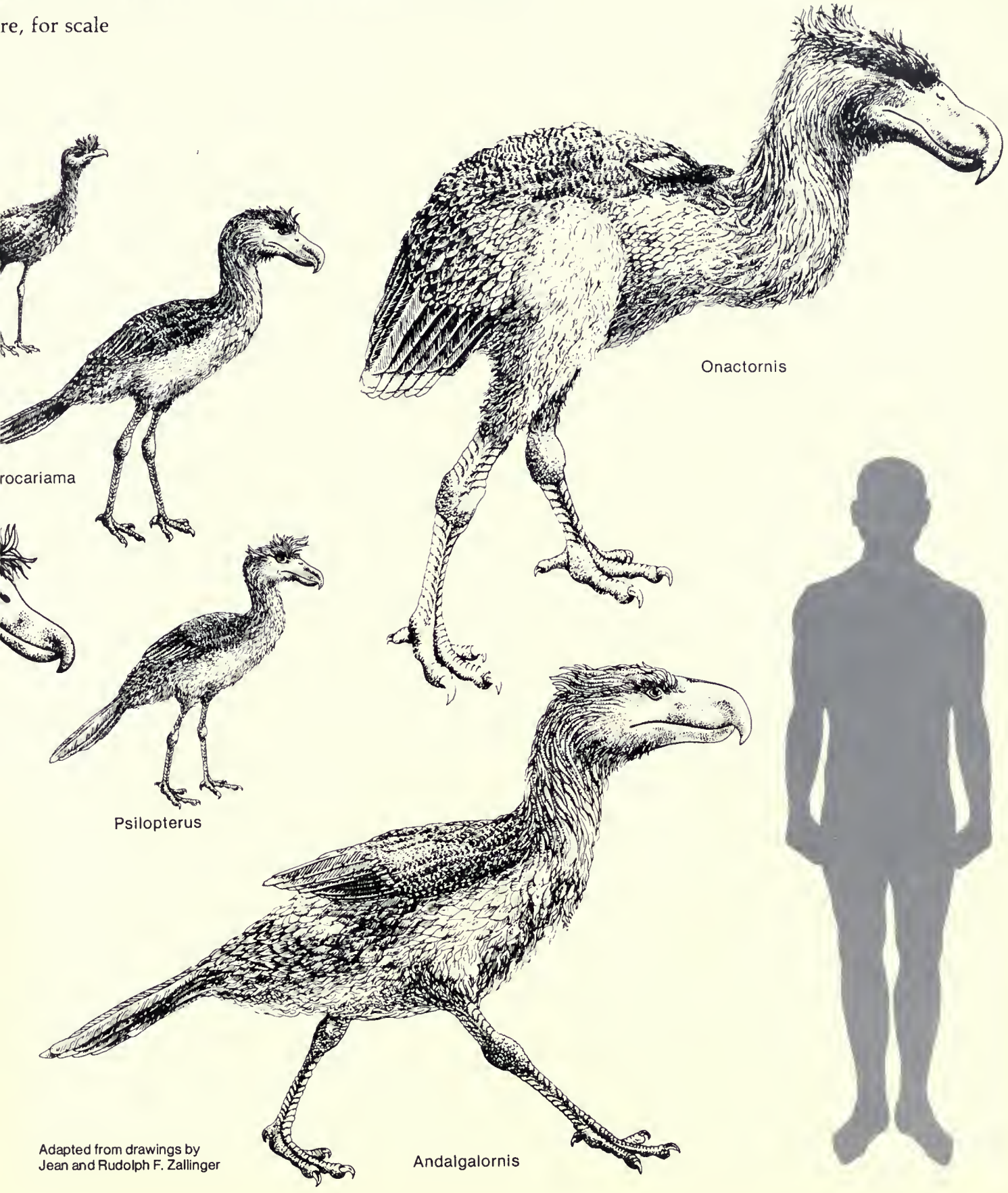
## Terror bird species that roamed Sout

Shown with living relative, cariama, and six-foot hun



# ıerica 3,000,000 to 35,000,000 years ago

re, for scale




Adapted from drawings by
Jean and Rudolph F. Zallinger

*Pawnee earth lodge model made by children at the Ancona School and inspired by Field Museum's Pawnee earth lodge, in Hall 5.*

# ANCONA SCHOOL COMES TO FIELD MUSEUM

BY CAROL BURCH-BROWN and MARY HYNES-BERRY

PHOTOS BY ELIZA HOUSTON DAVEY

Two women walked boldly to the Museum exit, carrying between them an unwieldy, table-size model of a Pawnee Indian earth lodge. A daring, daylight robbery? The young Museum guard could scarcely believe his eyes, much less find words to halt such a brazen act.

When finally stopped, however, one of the ladies blithely produced an official pass, which authorized removal of the model. Constructed at Ancona Montessori elementary school in Chicago's Hyde Park-Kenwood neighborhood, it had been on exhibit temporarily, during Field Museum's Members' Nights.

Perhaps the most significant thing about the Ancona model is the way in which its builders—fourth, fifth, and sixth graders—had drawn upon the Pawnee exhibits at Field

*Carol Burch-Brown is director of the Ancona Art Center, and Mary Hynes-Berry is Ancona School librarian.*

Museum and how their translation of that information had been a valuable learning experience. For them, the Museum's Pawnee exhibit was not just a briefly viewed curiosity, it had served them meaningfully and in a way that they might well remember for the rest of their lives.

According to the Montessori philosophy, the child is the critical agent in his own education. Moving from essentially concrete to mainly abstract activities, he constructs his own learning by assimilating facts and discovering principles. Facts and principles, say Ancona teachers, are of particular value when they are learned and put to use in a context that is personally meaningful to the child. It is within the setting of this philosophy that Field Museum has been an important social studies resource for Ancona.

Conveniently, the exhibits in the Museum galleries are arranged in categories that children can easily comprehend; and, as it happens, their arrangement is consistent with the Montessori approach to social studies. As the child proceeds from one exhibit case to the next, he becomes aware of the principles by which the artifacts are arranged. For example, he observes that every object in a particular case is an article of clothing of one tribe, that their weapons are in another case, and that religious objects and diagrams explaining their religious beliefs are in a third, and so on. The dioramas accompanying the displays further arrange the objects of each category, put them into context, and show more dramatically than any textbook could how a tribe's culture is its own unique response to its basic human needs.

But even though the information in the exhibits and dioramas is presented in a most accessible way, the Ancona staff recognizes that the child still needs guidance in utilizing this information; projects that draw upon Museum exhibits are thus designed with the teachers' personal guidance in mind.

Before the students make their initial museum visit for a particular project, they are prepared for the topic at hand through classroom study and discussion. At the Museum, in groups of five to ten, the children usually concentrate on a

*"We sawed and stripped sticks to make support elements. The Indians stripped theirs, too, but definitely not with X-acto knives! While we were doing that, and getting sore hands and making a huge pile of wood shavings, we talked about crazy things. It was a good day except for our sore hands from stripping wood. I liked that day a lot."*—From the journal of Elizabeth McCausland, student.

*"I made the bed of a young boy, Otter, and his grandmother. Here I am gluing posts to the base of the earth lodge to make supports for the bed and I am propping up the posts with little sticks until they are dry."*—Malcolm Paige, student.

few display cases previously selected by the teacher. While there, they fill out teacher-designed study sheets which require them to observe, record, and analyze what they have seen. Sometimes they make drawings of what they see; sometimes they relate or contrast their observations with material they already know. Later, in the classroom, the study sheets will provide groundwork for additional discussion and research.

Construction projects are often used at Ancona to reinforce what has been learned at the abstract level. As they design, construct, and assemble with their own hands, the children must apply what they have observed; frequently they realize that they have overlooked something and they return to observe more carefully. They come to realize that details are often important, and bear remembering.

In the fall of 1977, Ancona's fourth, fifth, and sixth grade teachers—Susan Agate, Anne Goudvis, and Annika Levy—decided to test the value of coordinating classroom learning with the resources of the school's art center and those of Field Museum. A newly developed curriculum on American Indian life at Ancona was to involve each student in a project of his or her choosing; the Pawnee earth lodge was chosen by ten children as their project. The lodge was a good selection on several counts: The Museum resources are extensive, to say the least, and the full-scale Pawnee earth lodge exhibit, opened in 1977 in Hall 5, could serve as a major stimulus to the children's imaginations. There are also two large dioramas of earth lodges from which the group could draw further information. Finally, the lodge is a superb illustration of Pawnee philosophy and social custom; it thus provides a good introduction to Indian belief systems.

In November, before the project got underway, I took a large number of students on a tour of the Museum's Pawnee exhibit. Edith Fleming, anthropology instructor in the Museum's Department of Education, made arrangements to accommodate our group. Most of the children who subsequently built their own model lodge at school were on this tour, so they already had some familiarity with and interest in the topic.

In January the project began with several long visits to the Museum. Together, the children and I made up a work sheet with questions about the lodge's construction and with space for their drawings of details. The group's first trip was to the Museum's Department of Exhibition, where they were able to see some of what is involved in the physical preparation of an exhibit. Their notes and sketches later eased the transition from looking to constructing and helped them become even more committed to the project.

After several visits and much note-taking, they began work on their own lodge, starting with the wooden framework and with the beds that are arranged along the lodge walls. They gathered sticks for the building's framework, stripped away the bark, and glued the sticks to a plaster base—a process which required altogether about six weeks. Their interest grew apace, even though a great deal of the work was monotonous. As one of them remarked about

bark stripping, "You think *this* is bad; just think what it was like for the Indians. They were working on long poles and they sure weren't using X-Acto knives!"*

To design and construct the beds and the lodge interior, the group relied heavily on information in *The Lost Universe*, by Gene Weltfish (Ballantine Books, 1975), a detailed account of life in a Pawnee village. Each child made a bed for the particular doll who slept there. Since the Pawnee assigned their beds according to the person's social function, the system of the Ancona children not only provided an organized way of distributing the work among themselves, but introduced them to Pawnee social practice. With the bed-making and later, the doll-making, the imaginative involvement of the children increased dramatically.

They saw their work now as symbolic of the larger task of the Pawnee, and as construction progressed they became more and more attentive to the significance that various parts of the lodge held for the Pawnee. For example, the children always took care that their model, like an actual Pawnee lodge, was facing to the east, so that the interior arrangements were in proper orientation to the four points of the compass. If anyone left an article in the lodge's sacred area—intended to hold nothing but religious articles—one of the children would complain, "Somebody left something in the *wiharu*!"

After the framework was done came the roof. The ceiling consisted of little bundles of broomstraw tied into mat-

*The X-Acto knife is a razor-sharp knife commonly used in art studios.*

*As the children made their straw mats they fitted them to the frame, trimming them where necessary. The entire frame of the lodge was covered with mats before the final covering of plaster was put on.*

*"On Tuesday it was the most fun time of all. We mixed plaster, dipped strips of old sheets into it and laid the strips on top of the straw mats which covered the frame of the lodge. Boy it was fun gushing around in the plaster! We had to work fast so it wouldn't set before we were finished. We didn't cover the back of the lodge so that people will be able to see into it. It will be finished soon so it can go to the Field Museum Members' Nights."*—From the journal of Elizabeth McCausland.

ting, and once again the children showed exemplary patience in making the mats. They were now deeply committed to their project, they had developed a group spirit, and they applied themselves with energy to even the most monotonous tasks.

In the sixteenth week of work the children were finally ready to apply the outer roof covering. This consisted of cloth strips soaked in a plaster-and-brown-paint (simulated mud) mixture. They found this task thoroughly enjoyable, completing it at last, plaster-splattered but jubilant. Next they had only to fashion the interior furnishings and to make the tiny dolls to be placed in the lodge. This more creative activity was a welcome change of pace after the long and often arduous process of lodge construction.

The project's culmination was placing the lodge on public display at the Museum for Members' Nights (along with other Indian projects made at the school). On each of the four nights, two teachers and several children were present to answer questions. So the project ended most satisfactorily—surpassing, in fact, the most optimistic hopes of the Ancona staff. It gave the children the chance to show their work and discuss it with an interested audience, to communicate something of what they had learned, and to act as transmitters of the knowledge they had gained.

The project itself demonstrated once again how effectively Field Museum can serve as an educational resource.

*At the Museum, the lodge model and several other projects made by the Ancona children were exhibited in the Department of Education. The children who made the projects were on hand to enjoy the occasion and to answer the questions of visitors.* ➤

### Battling Beach Erosion

Along our seacoast and the Great Lakes, shoreline erosion is a serious problem for industry, homes, and recreation. The U.S. Army Corps of Engineers annually spends millions of dollars trying to restore beach areas damaged by erosion. At Miami Beach, for example, the corps is trying to restore 10 miles of beach, the loss of which has had serious financial consequences for Miami hotel owners. The National Park Service is also concerned with beach restoration, since it administers 2,000 miles of shoreline under the national seashore and lakeshore program.

In a state of nature, shorelines are being constantly reshaped by seasonal storms, currents, and winds; yet this process may not result in severe erosion, for a beach is protected by a natural equilibrium existing among the opposing forces. But when human structures are set too close to the water's edge, they disturb this equilibrium and limit the ability of the beach to compensate for its severe losses in sand.

Fortunately, erosion—whether natural or manmade—will respond to human control efforts. There are, broadly speaking, two methods of controlling erosion: by constructing groins and sea walls and by replacing the lost sand. Each method has its advantages, but neither completely eliminates the problems associated with erosion.

Groins are piers, traditionally constructed of wood, concrete, or masonry, from 100 to 650 feet long, extending into the water at right angles from the shoreline. Their length is determined by the nature of the beach, whether pebble or stone, the latter requiring longer piers. Usually the groins are arranged in series, the distance between each pier determined by its length and the angle of the waves in the strongest storms. The effect of these piers is to cause the deposit of sediment and thus to rebuild a beach. A sea wall, placed parallel to the shore, protects it from large waves.

A new kind of groin, conceived in the Netherlands and developed in Denmark, was recently installed on Lake Superior at Madigan Beach in the Bad River Indian Reservation east of Odanah, Wisconsin. It is the Longard tube (so named because it is a long guard), a polyester plastic bag, 100 feet long, with a diameter ranging from 10 to 69 inches, which, after being positioned, is pumped full of sand and water. After the tubes are in place they are coated with a mixture of epoxy resin and sand that sets as hard as a rock. This coating is intended to protect the tube from vandalism and the action of ice.

A 69-inch tube, filled with sand, weighs about 2½ tons to the linear foot. Though the longest of these tubes would make only a relatively short groin, laying them end-to-end or overlapping them makes possible any length of construction. They have the advantage of making possible the construction of a 400-ton groin or sea wall in 4 hours, far less time than is required in the construction of a conventional breakwater. Such a breakwater is also far cheaper. Conventional groins may cost as much as $500,000 each, and sea walls cost between $200 and $500 per foot. Longard tubes, on the other hand, cost between $75 and $80 a foot installed. The Lake Superior construction, which employs a combination of tubes, costs about $95 a foot.

Whatever the financial advantages of the Longard groins and sea walls over conventional structures, they are not always a completely satisfactory solution to the problem of erosion, for in trapping eroding sands, they alter the natural flow of littoral sand and thus deprive the shore beach areas of replenishment. A better method of beach restoration, at least in the opinion of Robert Dolan of the University of Virginia, a noted authority on beach barriers, is beach nourishment, the closest approximation to the natural process whereby beaches are formed. It consists simply in the pumping or placing of sand on a beach to widen or flatten its profile and, in a sense, recreate the natural beach.

The sand placed on a beach does not always remain there. It is generally dumped on the beach above the water line, whence wave and wind move it into the offshore zone, whence, in time, much of it is carried back to shore. Such give-and-take action is part of the natural process of shoreline dynamics.

As with any restoration program, beach nourishment has some inherent problems. A large volume of suitably sized and textured sand must be applied to the beach area. Formerly most sand came from upland sources, but recent estuary studies coupled with the increased demand for sand as a building material have made these sources both ecologically and economically unsatisfactory. The trend is now to use submarine "borrow" pits, offshore.

The use of these pits creates some problems too. During the pumping process benthic organisms are destroyed and mobile invertebrates and fish are temporarily displaced. Increased turbidity and siltation, by-products of benthic disturbances, can degrade water quality along the borrow and nourished sites. Toxic substances which may have settled to the sea bottom may also become resuspended during dredging and pumping activities. And concerns have been voiced by commercial fishermen as to the impact of such disturbances on catch size and the entire offshore food chain.

Environmental damage can also occur where "polluted" sediments, dredged in the course of river and harbor maintenance, are applied to beaches and nearshore waters ostensibly for beach nourishment but in reality as a means of dredged material disposal. Great care must be taken in classifying such dredged material as "unpolluted" and therefore suitable for use in beach nourishment.

The biota on the beach can also be disrupted when the new sand is pumped onto the shore. Bird populations are temporarily displaced and most of the terrestrial beach invertebrates are destroyed. If sea turtles frequent a beach, the possibility exists that their eggs and hatchlings will be lost because of nourishment.

Much of this damage, however, can be minimized by careful planning so that project activities do not coincide with beach nesting times and periods of greatest population density. Periodic renourishment of the beach, usually every four years, will again adversely impact upon beach life unless similar precautions are taken.

### African Wildlife Running Scared

Wildlife once roamed the African continent by the millions. Although many species remain common, generally wildlife numbers have been greatly reduced. Now, the futures of an estimated 95 species of mammals in Africa, a diverse group representing 16 families ranging from 15 species of lemurs to the largest land animal of all, the African elephant, are threatened by human actions.

Fifty years ago more than 500,000 black lechwe (a deer-sized antelope) inhabited the Bangweulu floodplain in Zambia. Today, due to swamp drainage and uncontrolled taking, fewer than 10,000 remain. Swayne's hartebeest, now found in only one area south of Addis Ababa, Ethiopia, is considered the most endangered of the antelope. Less than 700 were counted in a census in 1976. The numbers of many predators, particularly the cheetah, brown hyena, and wild dog, have been steadily decreasing.

Many complex, interacting factors, observes John Hallagan of the National Wildlife Federation, are involved in this great decline—including habitat destruction and encroachment, poaching, and the failure of many African nations to enforce their own import-export regulations and wildlife protection laws—either intentionally or because of inadequate funds.

Loss of habitat is the most serious problem facing African wildlife today, notes Hallagan. As the human populations of African nations grow, more land is being put into crop production and ranching. Expansion of agriculture puts severe pressure on wildlife populations by forcing them into parks and reserves to minimize their interference with human activity.

Most parks do not enclose complete ecological units. Because migratory routes and home ranges often extend beyond park boundaries, the animals are considered trespassers on lands bordering the parks. If wildlife damages crops or livestock, the landowner often shoots the marauding animal; relocation of animals, even if considered, is too expensive or impractical. Cropping (killing a number of an overpopulated species so that a smaller, more healthy population may survive) has become necessary in many areas to alleviate the unhealthy, destructive pressure frequently accompanying overpopulation. The confinement of wildlife to restricted areas puts great strain on limited habitats. In particular, antelope and hippopotamus can overgraze an area, leading to severe soil erosion. This topsoil loss can damage a fragile area, making vegetative recovery extremely difficult.

Elephants are notorious for their ability to deforest vast areas of land by uprooting trees or stripping them of their bark while feeding. A classic example of this sort of habitat alteration occurred in Tsavo Park, Kenya, in the late 1960s and early 1970s. A huge overpopulation of elephants and an extensive drought combined to deforest the park. It may take more than a century to recover; thousands of elephants and large numbers of other species died during this period. Proper management through cropping may have averted this tragedy, but government officials ignored the data and recommendations of several researchers who predicted the crisis. Elephant habitat destruction not only reduces habitat for elephants themselves but for a wide variety of other species as well. Impala, oribi, buffalo, giraffe, leopard, and lion all depend on forested areas for cover, browse, or prey during some part of the year.

Although habitat loss is the primary cause of the decline in the numbers of many African species, poaching has also been a major contributor. Most publicized has been the elephant and rhinoceros, but other species have also been affected. The dik-dik, one of the smallest members of the antelope family, has been poached for its tiny but attractive horns which are made into keychains, tie clips, and other novelty items. Several thousand pairs of the finger length horns were recently confiscated in the port city of Mombasa, Kenya, awaiting export to the Orient, where products will be manufactured and re-exported or sold. Although the animal is not now considered threatened, continued poaching may have serious effects on dik-dik populations.

The East African black and white colobus monkey is a striking animal with a mantle of long white hairs growing out of a mat of shorter black hair. Unfortunately, its fur makes it attractive for the manufacture of rugs and coats. Although not considered endangered, both Kenya and Ethiopia have laws prohibiting its taking. Neither country has trade regulations for this colobus and dealers can export and import freely. Each claims that the skins came from the other country and that no monkeys are killed in their country to provide skins for trade.

Poaching is a big problem because it provides the potential for a person to make a great deal of money quickly and easily. In Kenya, a country with an annual per capita income of $220, a poacher may be paid the equivalent of $2 for a colobus skin. Likewise, the average world trade price of $16 per pound for ivory makes the poaching of elephants a profitable venture.

Tourism provides part of the market for both poachers and legally taken wildlife products. Some visitors to Africa like to take home unusual souvenirs like an elephant-foot wastebasket or a zebra-hide phonebook cover. Some products such as dik-dik horns also are exported to Asian countries and sold there as souvenirs to travellers. Luxury items such as ivory carvings and spotted cat furs are often cheaper in their country of origin, thus gaining popularity with tourists.

Sport hunting was once a large part of the African tourist industry and historically had a great impact on African culture and environment. Early hunters who publicized and romanticized Africa in the late 1800s contributed to a great influx of white Europeans into the continent. Unrestricted hunting for sport and food in the 19th and 20th centuries was a major factor in the decline of many species. In a situation similar to that of the opening of the American frontier, wildlife in Africa was killed in large numbers to make way for human settlement, beginning the trend toward the relegation of wildlife to parks and reserves.

Today hunting's impact on wildlife is minimal. Fewer hunters are taking fewer animals, particularly because of the high cost of hunting safaris; travelling expenses, license fees and accommodations may run well over $5,000 for a single trophy. The single largest problem confronting the implementation of conservation, education, and strong antipoaching programs is a lack of funds. Most African nations are hard-pressed to finance their domestic programs and cannot afford what appears to be the luxury of effective conservation measures. Several countries have promoted tourism as a form of revenue generation, but only Kenya, Tanzania, and South Africa have productive tourist industries, mostly game-viewing. Botswana and Zambia share most of the sport hunting in Africa today. Many countries have expressed interest in the sale of wildlife products (particularly elephant ivory) to finance conservation programs. The sale of ivory, hides, and meat from cropping programs could provide large amounts of revenue for conservation. Using wildlife through tourism and products sale, and therefore placing an economic value on it, says Hallagan, may be the only way for some countries to justify and finance sound conservation programs.

### Restoring the Atlantic Ridley Turtle

Biologists at Padre Island National Seashore, off the Texas Gulf coast, waited with baited breath in late June for delivery of the first batch of Atlantic ridley sea turtle eggs. More than 2,000 eggs, laid on the beach at Rancho Nuevo north of Tamaulipas on Mexico's east coast, were airlifted to Padre Island in an attempt to establish a second nesting colony of ridleys.

The Atlantic ridleys (*Lepidochelys kempi*), for some as yet unknown reason, nest primarily only on the beach in Mexico. The nesting usually begins in April or May, when the females gather offshore. They come onto the beach normally during a strong wind and in about 45 minutes lay between 100 to 125 eggs in pits dug out in the sand with their flippers. The same female may repeat this process two or three times during the nesting season. Unusual among the marine turtles, ridleys come ashore to nest in the daytime, instead of at night.

This spring, as this ancient, instinctive ritual took place, the eggs were laid into plastic bags so they did not touch the natal Mexican sand. Biologists theorize that a chemical in the sand, by osmosis or some other mechanism, may seep through the eggshell and imprint the embryos with the information that this is the site to which they must return ten years hence when they are mature females. To avoid this sand imprinting, the eggs were prevented from touching the Mexican beach.

After carefully gathering the eggs, workers placed them in styrofoam containers filled with Padre Island sand, on the hunch that if the imprinting theory is correct, the ridleys will return not to Rancho Nuevo but to Padre Island when the time comes for egg laying. Padre Island was selected as the site for a second colony because sporadic, individual ridley nesting has been documented on the island and because it is the only fully protected island in the vicinity.

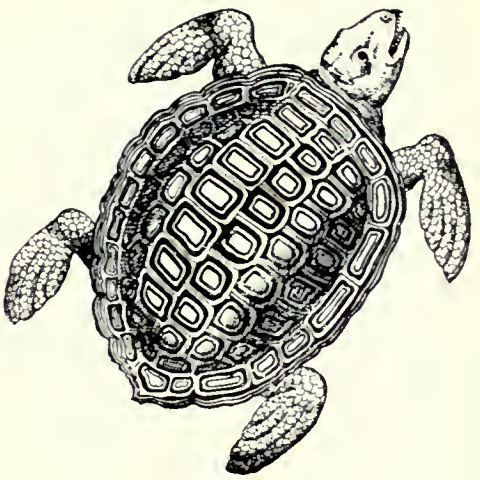
The sand and the water temperature or water chemistry are suspected factors in the turtles' early existence that may influence their return to the same nesting site. U.S. Fish and Wildlife Service (FWS) biologist Carol Justice explained that the normal hatching time of 42 days is a "pretty long time to be exposed to one constant," leading biologists to the sand-imprinting assumption. However, "the first rush down into the water" may also play a part, she said. But the subject is open to much uncertainty because "there are so many unknowns as far as the turtles' homing instincts," Justice added.

Biologist Peter Pritchard, who has studied with turtle expert Archie Carr, explained that ridleys thrust their snouts deep into the sand as if they are smelling it. Their highly developed glands may secrete a substance into the sand that they can later detect. All newly hatched ridleys exhibit a kind of frenzy, not aimless but highly directed, as they actively move away from land and swim stright out into the ocean. Once they reach the water they become relaxed, he said. How their migrations and coastal reunions occur is a miraculous but still mysterious phenomenon.

The stretch of beach at Rancho Nuevo, discovered in 1947, has been plundered by egg-gatherers who sell their bounty for the alleged aphrodisiac qualities the eggs possess and their desirability as a gourmet delicacy. When first discovered, about 40,000 females were observed nesting at Rancho Nuevo in a single day. Last year only about 200 were seen along the beach. According to National Park Service scientist Ro Wauer, the total ridley population has gone from about 250,000 to 2,500 observed last year. The International Union for the Conservation of Nature and Natural Resources' description of the species as the most endangered of all endangered species was what led Wauer and others to study the feasibility of the current project, he said. Participating in the current project are the National Park Service, the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, the Texas Parks and Wildlife Department, and Mexico's Instituto de Pesca.

Although the Mexican government has declared the beach a sanctuary, lean enforcement has made apprehension and punishment of poachers difficult. Beach patrols have been strengthened, however, and with U.S. assistance some 70,000 eggs have been moved to protected facilities until they hatch.

Poaching is not the only mortality factor for the ridleys, however. Jack Woody, the FWS representative in the interagency project, said predators such as dogs and coyotes on the beaches take their swipe at the newly hatched turtles on their determined flight to the surf. Although prohibited during nesting season, offshore commercial fishing also takes its toll as the turtles are caught in the shrimp trawler nets. Then, too, natural losses at sea drive up the first-year death rate.



To lessen these problems, the newborn turtles, after scurrying into the surf under watchful eyes, were picked up and taken to a National Marine Fisheries Service laboratory in Galveston, TX for "head-starting." During the first six months to a year, the young will be raised in a specially constructed turtle nursery. Two hundred turtles will be kept in each of 15 raceways, long troughs filled with sea water drawn from the Gulf, and in tanks.

The raceways will be drained and cleaned daily and refilled with chlorinated water, according to Jim McVey at the fisheries lab. Earlier small-scale experiments with other marine turtle species turned up disease problems that McVey is confident will not plague the ridleys. By sanitizing the water and isolating any individuals that show signs of sickness, he predicts a survival rate of 60 to 80 percent, much higher than in nature.

The initial period in which they first begin feeding is critical, McVey said. Prepared fish food and later some fresh-caught live foods will be fed to the hatchlings. In the last stages, the turtles will be put in larger bodies of water to develop swimming capabilities. For a going-away present, all the turtles will receive a mark or tag and some will carry miniature radio transmitters with them for tracking during the first week or ten days after their release into their natural environment.

It will probably be another eight to ten years before scientists know if the project has worked. If the ridleys' mysterious ocean migrations bring them back to the sand of Padre Island to nest, the imprinting hypothesis may have proved correct. Meanwhile, Moody said they hope to continue the egg transplants, incubations and

headstarting. And the U.S. will aid Mexico in saving and expanding the population at Rancho Nuevo.

On the other side of Mexico, however, prospects for the Atlantic ridley's cousin, the Pacific or olive ridley (*Lepidochelys olivacea*), are not so bright. Its major nesting area is at Escobilla in the province of Oaxaca on Mexico's western coast. While their populations are much higher, Pacific ridleys are also in demand for their eggs and their meat. A private company has opened a new slaughterhouse and laboratory in a nearby town to buy turtles from local fishermen. A court lifted a ban on taking olive ridleys, and last year a quota of 1,500 turtles a month for each of five fishing cooperatives was allowed. The turtles are taken before they have laid the eggs, and the company says it plans to remove the eggs, hatch them, and release the turtles. Experts are doubtful of the success of such an operation. Last October the third, large nesting of the olive ridleys failed, Pritchard and others think, because too many have already been killed.—*Rose Houk, National Wildlife Federation.*

### Fishery Progress in Great Lakes

Signs of progress mark current attempts to restore and maintain fishery resources of the Great Lakes, says the U.S. Fish and Wildlife Service (FWS). In many parts of the Great Lakes, fish populations are larger and more stable than populations were ten years ago, according to J. H. Kutkuhn, director of the Great Lakes Fishery Laboratory in Ann Arbor, Mich.

Although Kutkuhn admitted that it is not yet technologically feasible to assess the total role played by pollution abatement in rehabilitating fishery resources, he said efforts to improve the lakes' water quality contribute significantly to the well-being of humans and fish life as well.

"In pointing to these indicators of new vitality in the lakes," he said, "we do so without implying that healthier fish communities are necessarily the sole, direct, and unequivolcal result of improved water quality and a generally cleaner, less polluted environment."

Fishery management tactics, including separate and joint efforts by U.S. and Canadian agencies, are believed to be significant contributions that weigh heavily in the improved condition. Kutkuhn is uncertain about which combination of tactics seems to be getting the job done, but he noted that the signs of progress reflect increasingly effective management throughout the ecosystem of the Great Lakes.

Chief among management's efforts are tighter regulation of fisheries; control of the sea lamprey; fish stocking; reduction of fish losses associated with large-scale withdrawal of water; and mitigation of lowered carrying capacity due to physical alteration of habitat.

Kutkuhn's current analysis of the Great Lakes, principally in terms of the kind, number, size, and quality of fish they yield, is described in the following breakdown:

- **Whitefish** stocks in northern Lake Michigan, Green Bay, and the boundary waters of Lakes Superior and Huron continue to prosper. Annual (commercial) landings of this important native species now average more than twice the volume they yielded in the late 1960s.
- **Walleye** in the western basin of Lake Erie have rebounded dramatically from their decimated state of less than 10 years ago. The walleye population for which western Lake Erie has long been famous is believed to be at or near the basin's carrying capacity for this species.
- **Lake trout** across the upper Great Lakes, with some exceptions locally, are now growing, surviving, and sustaining fisheries to a degree unforeseen a dozen or so years ago. The numbers of mature lake trout in Lakes Michigan, Superior, and Huron, the result of restoration efforts, are as great (or nearly so) as they were during the 20 years of intensive commercial fishing for this species preceding World War II. Natural reproduction is increasing in Lake Superior and has been noted in Lake Michigan.
- **Pacific salmon**, especially chinook and coho, continue to support an excellent recreational fishery in Lake Michigan, and lesser though equivalently valuable ones in all other Great Lakes.
- **Brown and rainbow (steelhead) trout** also seem to be on the increase in nearshore areas throughout the Upper Great Lakes and in Lake Ontario. They, too, are making significant contributions to rapidly growing sport fisheries on both sides of the international boundary.
- **Prey (or forage) fishes**—mainly alewives, gizzard shad, and smelt—represent healthy populations now being kept in satisfactory balance wherever they predominate in the Great Lakes by (1) large and growing stocks of predator species including many of those mentioned above, (2) commercial fishing such as that for smelt in Lake Erie and alewife in Lake Michigan, and (3) natural causes induced, for example, by the severe and protracted winters of recent years.

In spite of the significant gains, Kutkuhn said fishery rehabilitation (and fish stock) in the Great Lakes is far from having fulfilled the expectations many hold for it. He cautioned that some major fishery-related problems resist solution; others await attention; and all are very complex technically, politically, or both. Kutkuhn said there are "troublesome impediments" that need to be overcome before the full potential of the Great Lakes will be realized. For example:

- Reduced stocks of yellow perch in southern Lake Michigan, western Lake Erie, and Lake Ontario—long the objective of vigorous commercial and sport fisheries—have been slow in responding to various management schemes designed to restore their former productive capacity.
- Conflict among groups competing for the use of certain species—sport and commercial fishermen for lake trout, walleye, and yellow perch generally, and Indians for lake trout in the upper Great Lakes additionally—hampers application across the lakes of a more objective and unified philosophy of fishery management than now exists.
- Depleted stocks of chubs in Lake Michigan and lake herring in Lake Superior continue to offer only faint promise of recovery despite efforts of fishery managers.
- Impairment of Great Lakes fish habitat, carrying capacity, and productivity is persistently threatened by the potentially adverse effects of accumulative alterations in the environment from a great variety and large number of proposed water-use developments.
- Insufficiently checked contamination of Great Lakes waters, biota, and fishery products poses yet another very serious problem, which, if allowed to continue unresolved, promises to undermine much if not all of the fishery-management progress made to date.

Kutkuhn goes on to say that DDT and mercury residues in Great Lakes fishes have, with some minor exceptions, generally dropped below tolerance levels set by public health authorities. Although PCBs and Mirex are now tightly restricted as to production and use, their residues in fish have yet to decline significantly. Dieldrin, too, still poses a problem in some areas.

# Edward E. Ayer Film Lecture Series

## October and November

***Saturdays, 2:30 p.m.***

This season's film lectures are to be held in James Simpson Theatre. The entrance to the theatre is conveniently located just inside the Museum's west entrance. This is of special interest to the handicapped, for the west entrance is at ground level and all steps between curbside and theatre have been eliminated. The west entrance also provides free admission to the theatre. Access to other Museum areas, however, requires the regular admission fee (except on Fridays) or membership identification. Plan to have dinner in the Museum's dining area before attending the lectures.

The illustrated lectures are approximately 90 minutes long and recommended for adults. Reserved seating is available, until 2:25, for members and their families. Doors open at 1:45 p.m.

---

OCTOBER 7

**"Turkey"** *Presented by Willis Butler*

Strategically situated Turkey is at the crossroads of two continents. This film shows splendid scenes of Ankara, the capital; the Turquoise Coast where the Taurus Mountains sweep down to a Mediterranean beach; Aphrodisias, where a great culture flourished 4,000 years ago; and Ayaca, a typical village.

OCTOBER 14

**"Poland"** *Presented by Sherilyn and Matthew Mentes*

Discover the industrial, agricultural, and cultural life in Poland from the Western to Central provinces. City and village life are highlighted in this fascinating film.

OCTOBER 21

**"The Spell of Ireland"** *Presented by Bill Madsen*

The "spell" is Ireland's people and the countryside. A revealing view from Adare to Glencolumkille and Blarney Castle.

OCTOBER 28

**"Winter Magic Around the World"** *Presented by John Jay*

Famous winter events in the mountains of Canada, Switzerland, Colorado, France, Persia, New Zealand, and Japan. John Jay has an uncanny ability to bring gentle humor to this exhilarating topic.

NOVEMBER 4

**"Outback Australia"** *Presented by Ken Armstrong*

A former, award-winning foreign correspondent, Armstrong takes us on a panormaic journey through the lesser known regions of this island continent; gold-mining, boat-racing, ranching operations, daily life of the primitive aborigine, and scenes of Australia's unique wildlife in their natural habitat.

NOVEMBER 11

**"Scotland"** *Presented by William Sylvester*

A specialist in the European scene, Sylvester has won awards at the Cannes and other film festivals. On this film journey we visit with him the weaving, farming, and fishing activities of the Western Isles, see an Old Norse midwinter ceremony and Highland games, explore ancient Scottish castles, and visit Loch Ness—home of the fabled monster.

NOVEMBER 18

**"Puerto Rico: Land of Two Cultures"**
*Presented by John W. Roberts*

A revealing story of an attractive and often overlooked region. Featured are visits to El Morro Fort and Old San Juan, daily life, night spots, industry, a rum plant, and sugar cane harvesting, raising of the *Paso Fino* horses, and a tropical rain forest.

NOVEMBER 25

**"Grand Canyon by Dory"** *Presented by Martin Litton*

Litton guides us down the exciting white-water rapids of the Colorado, shows us plant and animal life of the canyon, and treats us to breathtaking views from Lee's Ferry to Lake Mead.

# October & November at Field Museum

*(October 15 through November 15)*

### New Exhibits

**Rails of the World.** Opens November 11. An exhibition of 42 watercolors, painted by J. Fenwick Lansdowne, represents the little-known bird family of Rallidae. The exhibition is part of a national tour organized by the Smithsonian Institution Traveling Exhibition Service (SITES). A combination of art, science, and artistic realism, the works were painted by Lansdowne to illustrate the book *Rails of the World*, by S. Dillon Ripley, Secretary of the Smithsonian. Hall 21. Through January 28, 1979.

### Continuing Exhibits

**Imperial China: Photography 1846-1912.** A rare collection of 145 photographs exemplifies the kinds of pictures that gave the 19th-century Western world its first look at the "real China." These vintage prints, captured by pioneer photographers, provide glimpses of life during the waning years of the Ch'ing Dynasty, including the Dowager Empress at court, the street merchant, and the criminal awaiting execution. This exhibition was jointly organized by Asia House Gallery and the American Federation of Arts. Hall 27. Through November 12.

**Lake Michigan: An Endangered Natural Heritage?** This mini-exhibit allows a close-up view of Lake Michigan ecology and asks 20th-century man to function with a concerned eye to the future. Otherwise, this rich, aquatic environment will be irrevocably altered in 100 years' time. Second floor South Lounge.

**Cash, Cannon, and Cowrie Shells: The Nonmodern Moneys of the World.** Opened August 15. A fascinating collection that contains over 80 varieties of money used by ancient cultures of the world. It explores the origins, values, and meaning of nonmodern money in terms of buying power for these past civilizations. The accompanying text evaluates the worth of each form of money by considering food prices in ancient times. Four general categories of nonmodern moneys are on display: metal coinage, uncoined metal, shell money, and a miscellaneous group which includes currencies made of food, fur, fiber, glass, teeth, and stone. No closing date. Between Halls K and L, ground floor.

**Field Museum Gamelan.** Field Museum's 19th-century Japanese gamelan, an ensemble of 24 fine bronze and wood musical instruments, has been completely restored for exhibition. It is the oldest and perhaps finest gamelan outside Indonesia. Hall K, ground floor.

**Pawnee Earth Lodge.** This exhibit, in Hall 5, is a traditionally made Pawnee earth lodge—the home and ceremonial center of Pawnee Indians as it existed in the mid-1800s. Daily programs provide the opportunity to learn about Pawnee culture. Public program hours: Monday through Friday, 1:15 p.m.; weekends, 11:00 a.m. and 1:15 p.m. Tickets may be obtained during the hour prior to the program at the North Information Booth. Programs limited to 30 people.

**The Place for Wonder.** This gallery provides a place to handle, sort, and compare artifacts and specimens. Weekdays, 1 p.m. to 3 p.m.; weekends, 10 a.m. to noon and 1 p.m. to 3 p.m. Ground floor, near elevator.

### New Programs

**Festival of International Music and Dance Series:** October 16, November 6, and December 4. 8:00 p.m. James Simpson Theatre:

"Bugaku." First in a series of 3 programs in the International Festival of Music and Dance sponsored by Field Museum. *Bugaku*, the 1,000-year-old ceremonial dance of the Japanese Imperial Household will be performed October 16 by 17 musicians and dancers of the Osaka Garyo-Kai at Field Museum. The performers, wearing fierce masks and ornate costumes depicting the dress of ancient Japanese warriors, will dance to traditional music known as *Gagaku*, an ensemble of gongs, drums, flutes, and string instruments. Series admission (3 programs): members, $12.00; nonmembers, $15.00. Single program admission: members, $5.00, nonmembers, $6.00. Members' dinner: $7.50 each.

"Orchestral Ensembles of China, Thailand, and Indonesia." Part II of the Festival of International Music and Dance features Dr. Kuo-Huang Han directing the Balinese gamelan and the Chinese orchestra with dance on November 6.

**World Music Program for Children.** With Ira Kersh. For members' children. Series II, on October 7, 14, and 21, introduces children to Asian and North American Indian cultures. Students learn about other cultures through songs, stories, and handling musical instruments from around the world.

*Calendar continued on back cover*

MR AND MRS GARY SPENCER
APT 2106
5445 N SHERIDAN ROAD
CHICAGO ILL 60640

# October & November at Field Museum

*(CALENDAR continued from inside back cover)*

**Fall Environmental Field Trips.** Field Museum offers one-day field trips to neighboring areas of biological and ecological significance. Visit Matthiessen State Park or Black Partridge Stream on October 15, 21, or 22.

**Fall Journey for Children:** "Journey into the World of Money." Through December 31. This journey explains what today's dollar would be exchanged for in an ancient Aztec or Chinese city. The tour also shows what kind of offering a visitor would bring to pay homage to an ancient African king. Free *Journey* pamphlet at the Information Booth, main floor. Bring pen or pencil.

**Adult Education Program.** Field Museum offers noncredit, undergraduate evening courses in anthropology and the natural sciences beginning in October.

**Edward E. Ayer Film Lectures** are scheduled every Saturday afternoon in October and November at 2:30 p.m. James Simpson Theatre. Reserved seating is available for members and their families. Doors open at 1:45 p.m. For further information, see page 26.

| | |
|---|---|
| Oct. 21 | *The Spell of Ireland*<br>by Bill Madsen |
| Oct. 28 | *Winter Magic Around the World*<br>by John Jay |
| Nov. 4 | *Outback Australia*<br>by Ken Armstrong |
| Nov. 11 | *Scotland*<br>by William Sylvester |

### Continuing Programs

**Friend or Foe? The Natural History Game.** Field Museum's popular *Anthropology Game* has now been expanded to include botany, geology, and zoology. The object here is to determine which one of a pair of apparently similar specimens is harmful and which is not. Some of the more dangerous playing elements include: a vampire bat, a headhunter's axe, a poisonous mineral, and a deadly mushroom. Ground floor; no closing date.

**On Your Own at Field Museum.** Self-guided tour booklets, adult- and family-oriented, are available for 25c each at the entrance to the Museum Shop, main floor north.

**Weekend Discovery Programs.** Guided tours, demonstrations, and participatory activities. Every Saturday and Sunday, 10 a.m. to 3 p.m.

### October and November Hours

**The Museum opens daily** at 9 a.m. and closes at 5 p.m. (4 p.m. beginning November 1) every day except Friday. On Fridays the Museum remains open throughout the year until 9 p.m.

**The Museum Library** is open weekdays 9 a.m. to 4 p.m. Obtain a pass at reception desk, main floor.

Museum telephone: (312) 922-9410

November
1978

# Field Museum of Natural History Bulletin

# Field Museum of Natural History Bulletin

November, 1978
Vol. 49, No. 10

*Editor/Designer:* **David M. Walsten**
*Production:* **Oscar Anderson**
*Calendar:* **Mary Cassai**
*Staff photographer:* **Ron Testa**



## Field Museum of Natural History
Founded 1893

*President and Director:* **E. Leland Webber**

BOARD OF TRUSTEES

William G. Swartchild, Jr., *chairman*
Mrs. T. Stanton Armour
Goerge R. Baker
Robert O. Bass
Gordon Bent
Harry O. Bercher
Bowen Blair
Stanton R. Cook
O. C. Davis
William R. Dickinson, Jr.
Thomas E. Donnelley II
Marshall Field
Nicholas Galitzine
Paul W. Goodrich
Hugo J. Melvoin
William H. Mitchell
Charles F. Murphy, Jr.
James J. O'Connor
James H. Ransom
John S. Runnells
William L. Searle
Edward Byron Smith
Robert H. Strotz
John W. Sullivan
Mrs. Edward F. Swift
Edward R. Telling
Mrs. Theodore D. Tieken
E. Leland Webber
Julian B. Wilkins
Blaine J. Yarrington

LIFE TRUSTEES

William McCormick Blair
Joseph N. Field
Clifford C. Gregg
Samuel Insull, Jr.
William V. Kahler
Remick McDowell
James L. Palmer
John T. Pirie, Jr.
Donald Richards
John M. Simpson
J. Howard Wood



*Field Museum of Natural History Bulletin* is published monthly, except combined July/August issue, by Field Museum of Natural History, Roosevelt Road at Lake Shore Drive, Chicago, Il. 60605. Subscriptions: $6 a year; $3 a year for schools. Museum membership includes *Bulletin* subscription. Opinions expressed by authors are their own and do not necessarily reflect the policy of Field Museum. Unsolicited manuscripts are welcome. Postmaster: Please send form 3579 to Field Museum of Natural History, Roosevelt Road at Lake Shore Drive, Chicago Il. 60605. ISSN: 0015-0703.


CONTENTS


**3** **Field Briefs**

**4** **Our Environment**

**6** **The Borden-Field Museum 1927 Alaska Arctic Expedition**
*By Ted Karamanski and Dave Walsten*

**10** **China-Watchers of Yesteryear**
*By Audrey Hiller*

**16** **Solem and Snails**
*By Patricia Williams*

**27** **November and December at Field Museum**
Calendar of Coming Events


COVER

*Autumn Leaves.* Photo by John Kolar.

# FIELD BRIEFS

**New Exhibit: "Rails of the World"**

An exhibition of 42 watercolors representing the little-known bird family Rallidae, "Rails of the World"—paintings by J. Fenwick Lansdowne—opens Saturday, November 11 in Hall 21 and continues through January 28. The exhibition is part of a national tour organized by the Smithsonian Institution Traveling Exhibition Service.

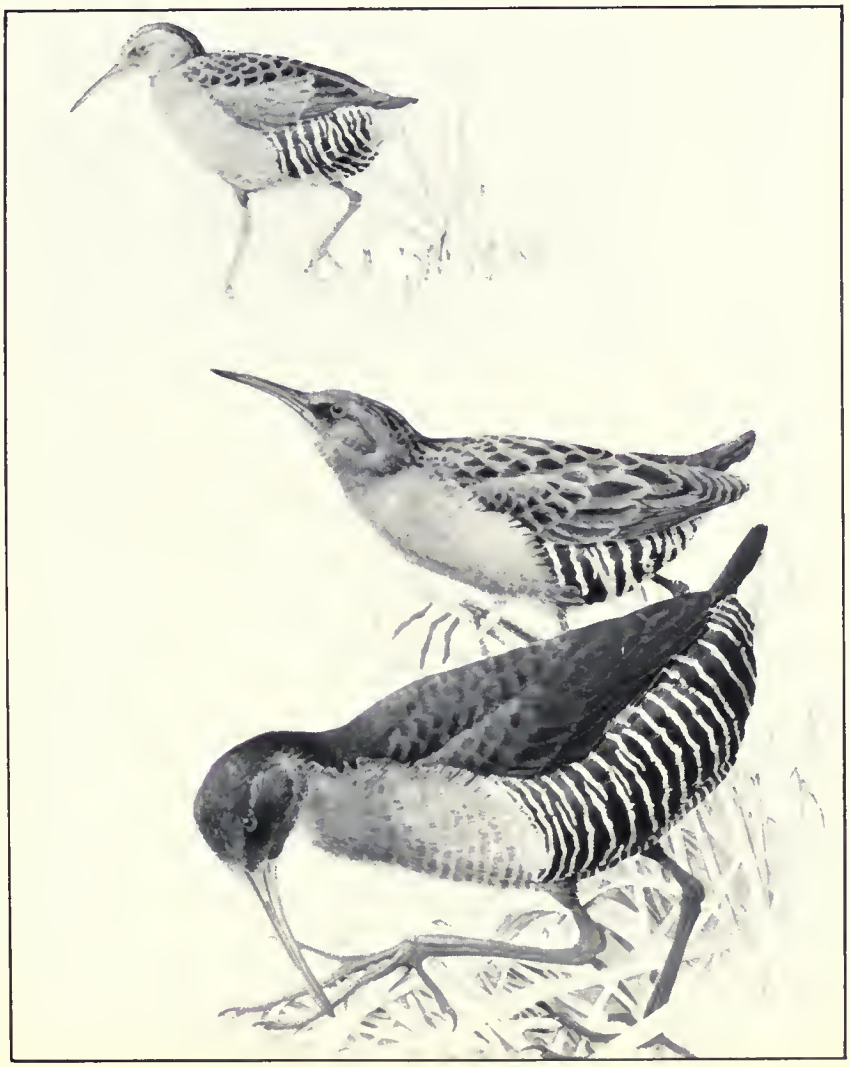
Continuing the tradition of the great artist/naturalists, the Canadian Lansdowne combines art and science with meticulous realism. The works were painted to illustrate the book *Rails of the World* by S. Dillon Ripley, Secretary of the Smithsonian. They are lent to the Smithsonian by M. F. Feheley of Toronto.

J. Fenwick Lansdowne, recognized as one of today's finest painters of birds, is a self-taught artist. Born in Hong Kong of British parents, he was brought to Canada at the age of three to settle in Victoria, British Columbia. When about five, he learned from his mother, a watercolorist, to use paints and to identify the birds in their garden. With John A. Livingston, a leading Canadian naturalist, Lansdowne brought out his first book, *Birds of the Northern Forest*, in 1966 and followed it two years later with the first of two volumes on *Birds of the Eastern Forest*. He wrote and illustrated *Birds of the West Coast*, Volume I, published in 1976.

Lansdowne studies his subjects in the field, then uses museum collections of bird skins to gain the fidelity of detail and color for which he is famous. He began work on paintings of rails about 12 years ago for Ripley's monograph on these threatened marsh birds.

The family of birds, Rallidae, which includes rails, coots, and gallinules, is among the least known and most elusive. Found throughout the world except in the arctic and antarctic, rails colonize the remotest islands, the most impenetrable jungles, and the most desolate shorelines. Yet, despite this broad global distribution, they remain a scientific enigma. For, once having arrived at a suitable habitat, they often lose their power of sustained flight and, over the centuries, their instinct for migration. Once settled, they colonize, gradually abandoning typical migratory patterns.

For a quarter century, Ripley has been studying these elusive creatures, noting their habits, dispersal patterns and social customs. Sadly, he finds their past littered and their future darkened with recently extinct and soon to become extinct species. Rails are particularly vulnerable to predation: they don't fly, are fine game birds, and being ground dwellers are especially susceptible to feral animals. The days are numbered for many species among the family Rallidae.



*"Water Rail, Bogota Rail, Kaffir Rail," watercolor by J. Fenwick Lansdowne. Exhibit of 42 paintings—"Rails of the World"—by the renowned Canadian artist opens Nov. 11 in Hall 21*

FIELD BRIEFS
*Continued on page 26*

# OUR ENVIRONMENT

### Geothermal Heat as Energy Source

Have you ever heard of a city sitting on its own power plant? That could be said of Reykjavik, meaning "smokey bay," the name given what is now Iceland's capital by the first Viking settlers because of the steam that rises from the ground. The city of approximately 120,000 gets almost all of its space-heating energy from underground geothermal sources. It is the oldest and largest geothermal heating service in the world, dating to 1928, when the first holes for hot water were drilled. That first experimental venture supplied enough water to heat 70 houses and two city swimming pools. Today, virtually the entire city has thermal heating. Three-fourths of the city's geothermal energy is extracted from a number of holes in the downtown area at the rate of 80 gallons of 128° water per second. The remainder comes by pipeline from a source 12 miles out of town. Drill holes are about 1,920 feet deep on the average, although some are as deep as 7,040 feet. Pump stations and insulated reservoir tanks ensure steady and uninterrupted supplies. Overall heat loss in the supply network, insulated with sod, rockwool, and foamed plastics, is about 11 percent. The outgoing cooler water is sometimes used to heat greenhouses or to keep pavements ice-free.

Usually geothermal water is impractical for municipal space heating because of excessive amounts of corrosive dissolved compounds. Although pipe maintenance and replacement is a substantial cost, Reykjavik's geothermal water is uniquely low in dissolved material. The only dissolved material of significant amount is silica, which is considered harmless. The water is germ-free, very soft, and the fluoride content is exactly what is recommended for dental protection. However, two elements, oxygen and sulphur, present potential problems. Dissolved oxygen corrodes the pipes and forms rust, leading to scaling by silica and other minerals. Dissolved sulphur compounds, causing the familiar "rotten eggs" smell of geothermal water, also corrode metal alloys, although reducing the amount of dissolved oxygen in the water at the same time. For these reasons, gases are separated from the water at the source.

The advantages of geothermal space heating, where suitable sources exist, seem to be beyond argument. Cost per BTU (British thermal unit) is only a third to a fourth of oil-fired heating at today's prices, for what seems to be an unending source. In addition, the absence of air or water pollutants and the lack of environmental disturbances in general, make geothermal energy very attractive. In the 1920s and '30s, before the general advent of geothermal heating in Reykjavik, a heavy cloud from coal combustion frequently hung over the city. Chimneys are not built on new houses today, except for the amenity of a fireplace.

Experts think there is ample potential for supplying the expanding population of Reykjavik and neighboring communities with geothermal energy. This potential is explained by the relatively young, porous bedrock of the area, sitting on the geologically active Atlantic Ridge. The next step in further geothermal development is expected to be a pipeline from a highly active geothermal area 30 miles east of the city, where dry steam at 230°C will be used for heat exchangers. Iceland is expanding its efforts to harness geothermal energy. Plans are underway to extract valuable minerals from geothermal brine; plants for geothermal processing of seaweeds for alginate production and diatomite for silica powder, are already in operation.

Although often promising, geothermal projects are not without risk. At Krafla in northern Iceland, a 70 megawatt dry steam electric power plant, the first of its kind in Iceland, has turned into a financial disaster. Although incomplete, the $41 million facility is Iceland's costliest project ever. It was intended to meet the pressing power needs of northern Iceland, as an alternative to a nearby hydroelectric dam project scrapped because of local opposition. With abundant supplies of steam on hand at temperatures as high as 300°C, power supplies seemed secure. However, intensive seismic and volcanic activity near the almost-completed steam turbine plant has either cut or seriously lowered yield from the 6,400-foot-deep drill holes that cost $600,000 each to drill. If the project goes down the drain, as is feared, the lost national investment could amount to no less than $185 per capita.

*Mammoth Hot Springs at Yellowstone National Park*

According to the former Federal Energy Administration's 1974 task force report on geothermal energy, electric power derived from high temperature geothermal steam could be competitive with oil at $4 per barrel, which obviously makes such projects attractive. However, suitable sources of sufficient power for commercial production are quite rare. One of the few such sources is at the Larderello field in Italy, where in 1904 the world's first geothermal power plant was built. Globally it seems that development efforts must be concentrated on other types of geothermal deposits, such as those under Reykjavik, or hot rock formations where cold water is pumped to be heated and extracted.

In the U.S. the California Geysers are producing 390 megawatts, or about 0.1 percent of the nation's total electricity demand. No other sources of dry steam are known to exist in the U.S. except those in Yellowstone National Park. Many feel that the U.S. geothermal power potential, as a major alternative energy source, has been seriously downplayed. Mainly to blame are technical and institutional constraints, plus pessimistic considerations of long-range reliability. However, the U.S. National Geothermal Energy Research Program has attempted to overcome those barriers. The program aims at encouraging the private sector to augment the commercial production of electric power by 20,000 to 30,000 megawatts by 1985, which would save the equivalent of one million barrels of oil per day. For the year 2000, the program's goal is 200,000 megawatts from geothermal sources.

These optimistic estimates have been corroborated by the results of recent studies. In any case, with demand for electricity doubling every 10 years, geothermal resources could, in the near future, provide at least one or two percent of the projected demand. Much further into the future is harnessing of the normal heat increase which occurs by descending into the earth's crust. This could lead to geothermal energy supplying 10 percent or more of the central and eastern states' electric power needs. Geothermal energy obviously could also make a difference in the energy-hungry United States.—Hermann Sveinbjornsson, from *Conservation News*.

### Polluted Fish, As It Were

A disgruntled employee of a French wine producer recently poured almost $600,000 worth of fine Burgundy into the sewers of a village, resulting in the poisoning death of thousands of fish, according to *Conservation News*. Wine flowed from the sewers of Nuits Saint Georges into the Meuzin River in eastern France, polluting it so heavily dead fish were found 12 miles away.

### Mercury Levels in Eskimos

Thirty persons in the Quebec Arctic settlement of Sugluk have dangerously high levels of mercury in their blood, according to the Quebec Department of Health.

Sugluk is an Eskimo community, and the high mercury levels are believed to have resulted from eating the meat of contaminated whales and seals. Some of the persons tested had levels 10 times higher than considered normal.

### Death for Illegal Logging

The Thai government is taking stern measures to save the country's remaining forests. The export of teak is now forbidden and the penalty for illegal logging is death. These measures were sparked by American satellite photography, which revealed a 35 percent decline in Thailand's forest area in the past 20 years.

Yachts are the principal users of teak and the ban will hit western boatbuilders hard. Not much of Burma's teak reaches western markets, while this "gemstone among woods" is of a lesser quality in India, Indonesia, and Central America.

Demand for Thai teak remains strong. American wholesale prices doubled in 1977 (before the ban) and a black market in teak logs is now said to be operating in Hong Kong.

### Sparrow Teriyaki Anyone?

A Japanese firm has recently informed the U.S. State Department that it is interested in buying American sparrows, preferably ones that weigh about 20 grams each and are frozen and ready to eat.

The Taiei Company, Ltd., of Tokyo, has told U.S. officials that it "wishes to buy whatever quantity an American firm can offer at regular intervals." The Japanese company has indicated that its representatives are ready to visit the United States to "give guidance on how to catch small birds and how to process them" into frozen foods for Japanese consumption.

### Fishing: A Heartfelt Experience

According to the Cortland Line Co., fishline manufacturers, successful angling can result in palpitations not to be found in any textbook on cardiology. It reports a bluegill fisherman who was catching them so fast he stuck one in his shirt pocket and forgot it. Later, feeling a fluttering in the chest region, he thought he was having a heart attack. A friend rushed him to a hospital emergency room, where an alert medical team quickly smelled out the problem.

### Homing Pigeons See Ultraviolet

Cornell University researchers have recently discovered that homing pigeons can see ultraviolet light, challenging a commonly held scientific assumption that all vertebrates, including humans, are blind to that portion of the light spectrum. The revelation may help explain how the pigeons navigate and may lead to new understanding of the process of vision. Using pyrex rather than glass to allow ultraviolet rays to pass through, the tests showed pigeons reacting with anxious heartbeat when ultraviolet rays were projected. How the light was sensed and whether it actually transmits images to the retina remain unanswered questions, however.


### Ownership, Management and Circulation

Filing date: Sept. 15, 1978. Title: *Field Museum of Natural History Bulletin*. Frequency of publication: Monthly except for combined July/August issue. Office: Roosevelt Rd. at Lake Shore Drive, Chicago, Ill. 60605.

Publisher: Field Museum of Natural History. Editor: David M. Walsten. Known bondholders, mortgagees, and other security holders: none. Nonprofit status has not changed during preceding 12 months.

| | *Av. no. copies each issue preceding 12 mos.* | *Actual no. copies single issue nearest to filing date* |
|---|---|---|
| Total copies printed | 86,000 | 86,000 |
| Paid circulation (sales through dealers, vendors, carriers) | none | none |
| Paid circulation (mail subscriptions) | 76,709 | 76,985 |
| Total paid circulation | 76,709 | 76,985 |
| Free distribution | 1,262 | 1,072 |
| Total distribution | 77,971 | 78,057 |
| Office use, left over | 8,029 | 7,943 |
| Total | 86,000 | 86,000 |

I certify that the statements made by me above are correct and complete. — Norman W. Nelson, asst. dir., admin.

# OUR ENVIRONMENT

### Geothermal Heat as Energy Source

Have you ever heard of a city sitting on its own power plant? That could be said of Reykjavik, meaning "smokey bay," the name given what is now Iceland's capital by the first Viking settlers because of the steam that rises from the ground. The city of approximately 120,000 gets almost all of its space-heating energy from underground geothermal sources. It is the oldest and largest geothermal heating service in the world, dating to 1928, when the first holes for hot water were drilled. That first experimental venture supplied enough water to heat 70 houses and two city swimming pools. Today, virtually the entire city has thermal heating. Three-fourths of the city's geothermal energy is extracted from a number of holes in the downtown area at the rate of 80 gallons of 128° water per second. The remainder comes by pipeline from a source 12 miles out of town. Drill holes are about 1,920 feet deep on the average, although some are as deep as 7,040 feet. Pump stations and insulated reservoir tanks ensure steady and uninterrupted supplies. Overall heat loss in the supply network, insulated with sod, rockwool, and foamed plastics, is about 11 percent. The outgoing cooler water is sometimes used to heat greenhouses or to keep pavements ice-free.

Usually geothermal water is impractical for municipal space heating because of excessive amounts of corrosive dissolved compounds. Although pipe maintenance and replacement is a substantial cost, Reykjavik's geothermal water is uniquely low in dissolved material. The only dissolved material of significant amount is silica, which is considered harmless. The water is germ-free, very soft, and the fluoride content is exactly what is recommended for dental protection. However, two elements, oxygen and sulphur, present potential problems. Dissolved oxygen corrodes the pipes and forms rust, leading to scaling by silica and other minerals. Dissolved sulphur compounds, causing the familiar "rotten eggs" smell of geothermal water, also corrode metal alloys, although reducing the amount of dissolved oxygen in the water at the same time. For these reasons, gases are separated from the water at the source.

The advantages of geothermal space heating, where suitable sources exist, seem to be beyond argument. Cost per BTU (British thermal unit) is only a third to a fourth of oil-fired heating at today's prices, for what seems to be an unending source. In addition, the absence of air or water pollutants and the lack of environmental disturbances in general, make geothermal energy very attractive. In the 1920s and '30s, before the general advent of geothermal heating in Reykjavik, a heavy cloud from coal combustion frequently hung over the city. Chimneys are not built on new houses today, except for the amenity of a fireplace.

Experts think there is ample potential for supplying the expanding population of Reykjavik and neighboring communities with geothermal energy. This potential is explained by the relatively young, porous bedrock of the area, sitting on the geologically active Atlantic Ridge. The next step in further geothermal development is expected to be a pipeline from a highly active geothermal area 30 miles east of the city, where dry steam at 230°C will be used for heat exchangers. Iceland is expanding its efforts to harness geothermal energy. Plans are underway to extract valuable minerals from geothermal brine; plants for geothermal processing of seaweeds for alginate production and diatomite for silica powder, are already in operation.

Although often promising, geothermal projects are not without risk. At Krafla in northern Iceland, a 70 megawatt dry steam electric power plant, the first of its kind in Iceland, has turned into a financial disaster. Although incomplete, the $41 million facility is Iceland's costliest project ever. It was intended to meet the pressing power needs of northern Iceland, as an alternative to a nearby hydroelectric dam project scrapped because of local opposition. With abundant supplies of steam on hand at temperatures as high as 300°C, power supplies seemed secure. However, intensive seismic and volcanic activity near the almost-completed steam turbine plant has either cut or seriously lowered yield from the 6,400-foot-deep drill holes that cost $600,000 each to drill. If the project goes down the drain, as is feared, the lost national investment could amount to no less than $185 per capita.

*Mammoth Hot Springs at Yellowstone National Park*

According to the former Federal Energy Administration's 1974 task force report on geothermal energy, electric power derived from high temperature geothermal steam could be competitive with oil at $4 per barrel, which obviously makes such projects attractive. However, suitable sources of sufficient power for commercial production are quite rare. One of the few such sources is at the Larderello field in Italy, where in 1904 the world's first geothermal power plant was built. Globally it seems that development efforts must be concentrated on other types of geothermal deposits, such as those under Reykjavik, or hot rock formations where cold water is pumped to be heated and extracted.

In the U.S. the California Geysers are producing 390 megawatts, or about 0.1 percent of the nation's total electricity demand. No other sources of dry steam are known to exist in the U.S. except those in Yellowstone National Park. Many feel that the U.S. geothermal power potential, as a major alternative energy source, has been seriously downplayed. Mainly to blame are technical and institutional constraints, plus pessimistic considerations of long-range reliability. However, the U.S. National Geothermal Energy Research Program has attempted to overcome those barriers. The program aims at encouraging the private sector to augment the commercial production of electric power by 20,000 to 30,000 megawatts by 1985, which would save the equivalent of one million barrels of oil per day. For the year 2000, the program's goal is 200,000 megawatts from geothermal sources.

These optimistic estimates have been corroborated by the results of recent studies. In any case, with demand for electricity doubling every 10 years, geothermal resources could, in the near future, provide at least one or two percent of the projected demand. Much further into the future is harnessing of the normal heat increase which occurs by descending into the earth's crust. This could lead to geothermal energy supplying 10 percent or more of the central and eastern states' electric power needs. Geothermal energy obviously could also make a difference in the energy-hungry United States.—Hermann Sveinbjornsson, from *Conservation News*.

### Polluted Fish, As It Were

A disgruntled employee of a French wine producer recently poured almost $600,000 worth of fine Burgundy into the sewers of a village, resulting in the poisoning death of thousands of fish, according to *Conservation News*. Wine flowed from the sewers of Nuits Saint Georges into the Meuzin River in eastern France, polluting it so heavily dead fish were found 12 miles away.

### Mercury Levels in Eskimos

Thirty persons in the Quebec Arctic settlement of Sugluk have dangerously high levels of mercury in their blood, according to the Quebec Department of Health.

Sugluk is an Eskimo community, and the high mercury levels are believed to have resulted from eating the meat of contaminated whales and seals. Some of the persons tested had levels 10 times higher than considered normal.

### Death for Illegal Logging

The Thai government is taking stern measures to save the country's remaining forests. The export of teak is now forbidden and the penalty for illegal logging is death. These measures were sparked by American satellite photography, which revealed a 35 percent decline in Thailand's forest area in the past 20 years.

Yachts are the principal users of teak and the ban will hit western boatbuilders hard. Not much of Burma's teak reaches western markets, while this "gemstone among woods" is of a lesser quality in India, Indonesia, and Central America.

Demand for Thai teak remains strong. American wholesale prices doubled in 1977 (before the ban) and a black market in teak logs is now said to be operating in Hong Kong.

### Sparrow Teriyaki Anyone?

A Japanese firm has recently informed the U.S. State Department that it is interested in buying American sparrows, preferably ones that weigh about 20 grams each and are frozen and ready to eat.

The Taiei Company, Ltd., of Tokyo, has told U.S. officials that it "wishes to buy whatever quantity an American firm can offer at regular intervals." The Japanese company has indicated that its representatives are ready to visit the United States to "give guidance on how to catch small birds and how to process them" into frozen foods for Japanese consumption.

### Fishing: A Heartfelt Experience

According to the Cortland Line Co., fishline manufacturers, successful angling can result in palpitations not to be found in any textbook on cardiology. It reports a bluegill fisherman who was catching them so fast he stuck one in his shirt pocket and forgot it. Later, feeling a fluttering in the chest region, he thought he was having a heart attack. A friend rushed him to a hospital emergency room, where an alert medical team quickly smelled out the problem.

### Homing Pigeons See Ultraviolet

Cornell University researchers have recently discovered that homing pigeons can see ultraviolet light, challenging a commonly held scientific assumption that all vertebrates, including humans, are blind to that portion of the light spectrum. The revelation may help explain how the pigeons navigate and may lead to new understanding of the process of vision. Using pyrex rather than glass to allow ultraviolet rays to pass through, the tests showed pigeons reacting with anxious heartbeat when ultraviolet rays were projected. How the light was sensed and whether it actually transmits images to the retina remain unanswered questions, however.


### Ownership, Management and Circulation

Filing date: Sept. 15, 1978. Title: *Field Museum of Natural History Bulletin*. Frequency of publication: Monthly except for combined July/August issue. Office: Roosevelt Rd. at Lake Shore Drive, Chicago, Ill. 60605.

Publisher: Field Museum of Natural History. Editor: David M. Walsten. Known bondholders, mortgagees, and other security holders: none. Nonprofit status has not changed during preceding 12 months.

| | *Av. no. copies each issue preceding 12 mos.* | *Actual no. copies single issue nearest to filing date* |
|---|---|---|
| Total copies printed | 86,000 | 86,000 |
| Paid circulation (sales through dealers, vendors, carriers) | none | none |
| Paid circulation (mail subscriptions) | 76,709 | 76,985 |
| Total paid circulation | 76,709 | 76,985 |
| Free distribution | 1,262 | 1,072 |
| Total distribution | 77,971 | 78,057 |
| Office use, left over | 8,029 | 7,943 |
| Total | 86,000 | 86,000 |

I certify that the statements made by me above are correct and complete. — Norman W. Nelson, asst. dir., admin.

*T. Ashley Hine (1876-1958), Field Museum's chief bird taxidermist 1922-1935, joined the expedition at Nome, Alaska, to secure bird specimens.*

# *The Borden-Field Museum 1927 Alaska Arctic Expedition*

*by* TED KARAMANSKI
*and* DAVE WALSTEN

IT WAS NO PLEASURE CRUISE, exactly, and it wasn't a scientific expedition in the conventional sense; but the "Borden-Field Museum 1927 Alaska Arctic Expedition" provided nearly five months of excitement, sport, and diversion for a group of wealthy Chicagoans. At the same time, the venture yielded hundreds of valuable ethnological specimens, plants, birds, and mammals for Field Museum's scientific collections.

Leader of the expedition was Field Museum trustee John Borden (1886-1961), a prominent Chicago attorney, founder of the Yellow Cab Company, and, incidentally, future father-in-law of statesman Adlai E. Stevenson (1900-65). An avid adventurer and sportsman, Borden had made two earlier hunting cruises along the Alaskan coast, in 1913 and 1916. He was eager to return to the arctic, but this time—probably because of his close ties with Field Museum—he was interested in doing something for science.

At that time—half a century ago—the hunting of big game was much in vogue, and it was the usual practice for scientific institutions, including natural history museums, to obtain specimens in this way. Since then, of course, museums have made significant changes in the manner in which scientific specimens are obtained.

Field Museum president Stanley Field (served 1908-64) and director D. C. Davies (served 1921-28) gave Borden the encouragement he needed to make the trip a major endeavor. "We were to go in search of great Alaskan brown bears on the Alaska Peninsula," wrote Borden's wife, Courtney, in her *The Cruise of the Northern Light* (MacMillan, 1928), a book-length account of the venture, "and in the Arctic Ocean such sea mammals as polar bears, walrus, and seals. Besides the big game, we were to take land and water birds and also collect flora and fauna from the barren tundras. With such a real and exciting objective my husband began the preparations which were to keep him busy the following nine months."

Chief among the preparations was the design and construction of a 140-foot vessel capable of withstanding rigorous arctic seas and ice floes and large enough to accommodate two dozen persons. Subsequently christened the *Northern Light*, the schooner was designed by Henry C. Grebe, Chicago naval architects, and built in Oakland, Cal., by W. F. Stone & Son. She was a twin-screw wooden auxiliary knockabout rigged schooner with a waterline length of 106 feet, eight inches, 30-foot beam, 15-foot draft, and 312-ton displacement. Her design was a combination of old-time whaler and Gloucester fisherman. The vessel's power plant consisted of two 4-cylinder, 120 brake h.p., two-cycle, solid injection Fairbanks-Morse diesel engines, and her cruising speed under engine power was 10½ miles per hour; she carried 7,563 square feet of working sail.

The hull was designed so that the vessel would rise up if she were squeezed by heavy ice. Additional protection from the ice was provided by a sheathing of iron bark over the hull

---

*Ted Karamanski is a doctoral candidate in history at Loyola University.*

# *Chicago Socialites, Sea Scouts, and Scientists Join Forces to Collect Specimens for Field Museum*

*Mrs. John (Courtney L.) Borden, wife of the expedition's sponsor.*

to about a foot above the waterline. The hull was 20 inches thick. On her deck she carried four dories; two sealing boats rigged for whaling; three canoes, including two with outboard motors; and a 25-foot launch. The *Northern Light's* fittings included a teakwood pilothouse and eight tons of brass. The ship's cost: $400,000.

Mrs. Borden noted in her account:

*The yacht had been decorated for practical use as well as comfort. There were no cigarette boxes, ash trays or lamps to be knocked off by a rough sea. Instead of glazed chintz and glaring white enamel wood work, the sofas were covered in a warm coarse material and the wood paneled walls were oiled and waxed. The dining table was a copy of an early American trestle table in the Metropolitan Museum. Instead of an ordinary sideboard we used an old Normandy doughchest studded with large brass nails which held games of all kinds (incidentally unused throughout the voyage.) The rest of the furnishings were nailed to the floor or built in the wall, and included three sofas, four chairs, a radio, an orthophonic victrola, and an Arcola heater.*

*Appropriate pictures hung on the walls. Pewter electric light fixtures were arranged above the sofas, and a reading-lamp over each bed, which I had imagined would come in very happily should I be seasick. Little did I know that reading was the last thing I would feel like doing!*

* * *

*In this modern day of steam, mates, engineers, etc., are easier to find for a sailing-vessel than are sailors. Mr. Borden suddenly struck upon the idea of taking sea-scouts to ship before the mast. As many people do not know what is a sea-scout, I must explain. This organization is part of the Boy Scouts of America; it provides recreation, romance, and proper leadership for boys of the restless ages of between fifteen and twenty years. . . .These boys are trained on small sailing boats, learning many of the first requirements of seamanship, some on salt water, others on the Great Lakes.*

*On this suggestion of Captain Borden lies one of the successes of our Expedition: the splendid crew with which we sailed. . . .*

*It was decided to call for volunteers among the Chicago boys in that organization. Every member unhesitatingly volunteered. And out of these some two hundred lads, after vigorous physical examinations, eight boys were chosen. Merit, of course, counted. Now that it is all over, everyone of us can honestly say: A finer lot of boys there never were. The experiment proved entirely successful, due to their willingness, cooperation, and their fine individual characters.*

*The lucky ones were: Johnson Powers, Bruno Andrews, Kenneth McClelland, Steven Ram, James Ryan, Jack Holbrook, Ted Purcell, and Otto Carstensen. The youngest was sixteen and the eldest twenty years of age. . . .*

In addition to John Borden, who was navigator as well as master, the crew included a veteran sea captain as execu-

*John Borden (dark coat) and his executive officer, William F. Joseph (rt., top row), with the Sea Scouts who served as the* Northern Light's *crew (standing): Holbrook, McClelland, Ram, Andrews, Purcell, Ryan; (above) Carstenson, Powers, Joseph.*

tive officer, first and second mates, a chief engineer, a second engineer, a radio operator, a chef, a steward, and a second cook.

*Mr. Borden and I left Chicago early in March and spent six weeks in San Francisco provisioning and equipping the yacht for the long journey. . . .[The purchase of provisions was] in itself a task that took careful attention; it was no small matter to provide for so many people on a six months' trip—keeping in view always the possibility of our being caught in the ice and having to remain somewhere in the Arctic wastes during a long Arctic winter. . . .*

*From the mainmast floated the New York Yacht Club pennant, flown on two former yachts of my husband: the* Adventuress, *on which he went to Alaska in 1913, the* Kanawha, *a steam yacht which he later loaned to the government and commanded along the English and French coasts during the war. The executive-committee flag of the Sea-Scouts of America waved from the foremast, instead of the owner's private signals.*

*On going aboard the afternoon before sailing, we thought she was indeed a sturdy little ship as she lay at the dock with her white sides gleaming in the sunlight of a California April day. . . .*

The beautiful white schooner sailed out of the Golden Gate on April 21; nearly five months of unknown adventure lay before her. On the second day out, Mrs. Borden wrote:

*The day continued fair and everyone on board had plenty of chances to become acquainted. The sun was so hot we burned terribly those first days, but our skins soon became impervious to it. We spent many hours catching Portuguese men-of-war. These small, exquisitely colored creatures dotted the sea, like tiny specks of sparkling ice. Harry lost his hat overboard and when Frances Ames [a friend who had come along to collect botanical specimens for the expedition] called "Too bad," he answered boastfully: "Oh, I've lost thousands of 'em."*

*During the afternoon a sea came up. Humiliatingly I was the first to descend after a proud assertion: "Yes, I'm a good sailor." When the steward announced supper at 5:30, nothing could raise me from my bed and I found to my secret delight that others were also abstaining from the evening meal. That night we had our first experience listening to the sea as it washed over the poop-deck above our heads. At seven o'clock the crew set the foresail and staysail and the ship became a little steadier. We headed straight into a nor'wester and only made five knots. My husband came below very late and was encouraging enough to admit that six of the sea-scouts were also ill.*

On April 27, the *Northern Light* cruised into the harbor at Victoria, British Columbia. The vessel remained there for several days while additional provisions were taken aboard. Mr. and Mrs. Charles B. Goodspeed and Mr. and Mrs. Rochester B. Slaughter, friends of the Bordens from Chicago, joined them on May 7 and the cruise resumed the next day.

*May 9: Our life on deck proved to be peaceful and delicious. There was so much of interest that the days passed all too quickly. It was quite warm; we needed no more clothing than heavy tweed suits. I took this opportunity to read John Caswell's* Sporting Rifles and Rifle Shooting, *and understood it better than Whelen's* American Rifle. *We jumped rope, played deck tennis, and did some target and clay-pigeon shooting. . . .*

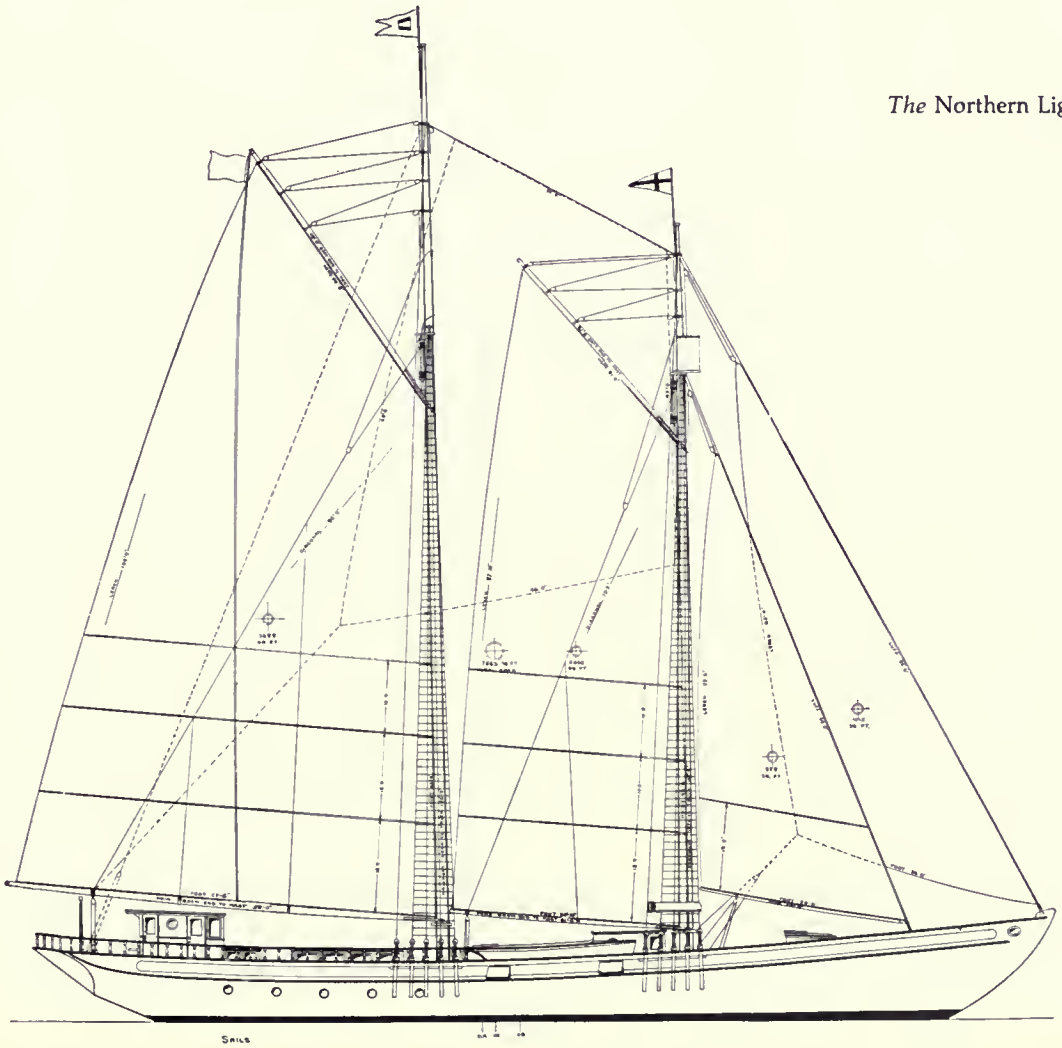
*After supper we stayed below in the main cabin, reveling in the exquisite peace of gently lapping waves against the sides of the boat. Hart [the radio operator] interrupted our quiet thoughts by coming below with the Wall Street financial news. It was actually annoying to still be in such close touch with the world. The message was radioed from Marion, Massachusetts, and broadcasted by the Chicago Tribune Radio Corporation News Service. The market was strong with United States Steel leading.*

By May 15, the *Northern Light* was only several hours out of Juneau, Alaska, as she sailed into Chatham Strait, between Baranof and Admiralty islands:

*. . . Shadows of trees and mountains flickered across a glass-like surface. Snow-covered mountains surrounded us with rugged white beauty, and from that enchanted spot, encircled by spruce-covered forests, we watched Baranof in all its majesty. A round blood-red evening sun gilded the summit and set ablaze the water. Although quite late, the dories and canoes were lowered and armed with shotguns and rifles, we paddled ashore to explore. On nearing land, many ducks flew up. My husband shot a Harlequin—a bird with a most perfect plumage. The Slaughters exploring, saw fresh deer tracks and an old bear track. The others fished and caught nothing but the bottom of the Bay. Then followed a radiant night, hours of complete enchantment when we seemed drugged by a world of beauty.*

*May 16: Awake at five o'clock because of the morning*

*Continued on page 20*



*The* Northern Light, *showing sail plan*

*A Chinese falconer and his bird. Falconry was practiced in China 4,000 years ago.*

# China-Watchers of Yesteryear

BY AUDREY HILLER

In 1908, when Berthold Laufer, Field Museum's newly appointed assistant curator of Asian ethnology, made his journey into China and Tibet, he was one of a few Westerners who, in those unsettled times, succeeded in penetrating beyond the capitals and coastal cities of Asia. It was the year of the death of the Manchu Emperor, Kuang Hsu, and of the Dowager Empress. Imperial China was in its death throes.

*Audrey Hiller is a Field Museum volunteer.*

For 4,000 years China had considered itself the focal point of the universe. When the Chinese called their land the "Middle Kingdom," they were referring not only to the condition of being surrounded by "barbarian" nations; they also had

*The last of the Manchu emperors, Hsuan T'ung, or Henry P'u-Yi (1906-67) at about age 3. Upon the death of his grandmother, the Dowager Empress, in 1908, he became emperor, but abdicated four years later. The Japanese made him puppet emperor of Manchukuo 1935-45. After the war he converted to communism.* ►

*The wall surrounding Peking, begun by Kublai Khan in the 13th century, here seems to have the quality of eternity, much like Egypt's pyramids. Today, however, it is largely destroyed. The benchlike objects visible here on the frozen moat are sleds.*

*At intervals, gates like that shown here penetrated Peking's massive walls.*

*This slide was labelled "Chinese and Manchu Women." The outer two women have bound feet, outlawed in 1912 but generally discouraged long before.*

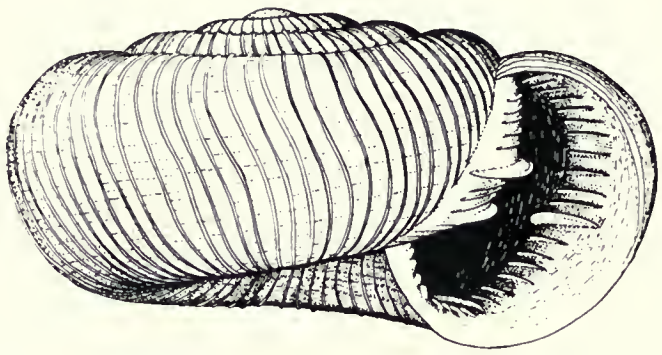
in mind that middle region between Heaven and Earth, with the Mandate of Heaven being conferred on China's ruler. By the nineteenth century, however, very mortal problems, visible even to the Chinese, presented themselves. Conflicts between provincial warlords, increasing demands for trade and other concessions by the Western powers, unsettling political ideologies from abroad, and economic invasion forced, eventually, a radical change in government. Reforms instituted by the emperor in 1898 were too little and too late to stem the tide of revolution. In 1912 the Chinese Republic was born.

While most visitors to China in the late 1800s and early 1900s were either traders or missionaries—unwitting tools in the great reform—a few were voyagers who, like Laufer, came for scientific or academic purposes; others were there simply as sight-seeing tourists. An astonishing number of these visitors, whatever their purpose, visually chronicled their journeys with the newly invented camera.

Some of their photos, like that shown at the legation gate (P. 14), are poignantly expressive of the strains between Eastern and Western culture.

The current Museum exhibit, "Imperial China: Photographs 1846-1912," on view in Hall 27 through November 12,

# SOLEM and SNAILS



*Snail species* Taipidon centadentata. *Drawing by Yoshio Kondo. from Solem's* Endodontoid Land Snails from Pacific Islands.

BY PATRICIA WILLIAMS

Writing the massive monograph *Endodontoid Land Land Snails from Pacific Islands (Mollusca: Pulmonata: Sigmurethra), Part I, Family Endodontidae* wasn't easy. Even the title is enough to slow down many people. Simple statistics give some clue to the complexity of the huge work by Alan Solem, Field Museum's curator of invertebrates: 50 quarto-size pages, 208 illustrations, and 114 tables contain details on 185 species and sub-species, 102 of them scientifically described for the first time. Published in 1976 by Field Museum Press, it covers this snail group from A to Z—literally: the index lists genera spanning the alphabet from *Aaadonta* to *Zyzzyxdonta.*

Although the book is impressive for its sheer size, it is, of course, the excellence of the work that merits special attention. A review by C. R. C. Paul in the June 1978 *Journal of Conchology* concludes, "Solem has set a new standard for systematic treatments of molluscan groups. Future workers will be forced to consider many more aspects of the groups they treat if they are to maintain this high standard." R. Stohler, reviewer for *The Veliger* (July 1978) summed up with "It is our opinion that Dr. Solem's work will be considered a classic in its field and that it will be accepted as a standard of the best of twentieth century taxonomy. He is to be commended on his industry and endurance, which were needed to bring this work to its successful completion."

This long-term project began when, as Solem explains in the introduction to the monograph, "My own interest in these taxa was sparked by the recovery of Miocene to Pleistocene fossil endodontoid snails from the deep-core drillings on Bikini, Eniwetok, and Funafuti atolls. . . . I had worked on endodontoid species from the New Hebrides . . . and examined the limited Polynesian material in mainland American museums. Seeing the fossil species suggested that a revision of the living endodontoid taxa from Polynesia and Micronesia might provide insights into historical zoogeography of that region, present a time dimension to the colonization of the islands, and permit some observations concerning the rate of evolution in these island populations. I was led to believe that perhaps 100 living species might be involved in such a survey. Exposure to the vast collection resources of the Bernice P. Bishop Museum [in Honolulu] soon wrought drastic revisions in this program. The fossils barely show species or species group differentiation from living taxa, add only one major modification to a current geographic range, and provide no significant data concerning possible evolutionary rates . . . . The huge quantity of material, potentially 84,000 specimens of 573 species level taxa, soon led to quite a different focus than simple species sorting and classification formation."

Intensive work on the project got underway in 1961 and before it was completed some 26,000 specimens were studied in detail and perhaps an additional 6,000 specimens were examined quickly.

"In complexity the project exceeded the initial objectives," Solem says. "One of the primary objectives turned out to yield comparatively minor information. That is, I was hopeful that it would yield information on changing biogeographic patterns through time on the Pacific Islands, but it turned out that there's been very little change in the last 15 million years. This in itself is highly significant, but it's not the type of information that had been anticipated."

Solem's evidence indicates that life on the islands of Polynesia and Micronesia has been relatively stable instead of rapidly changing. Most evolutionary theorists have assumed

---

*Patricia Williams is managing editor of Field Museum's scientific publications.*

that because the islands are young, life forms there must also be phylogenetically young. Showing that one group has essentially reached its present level of diversification 15 million years ago will cause some major rethinking in terms of the whole pattern of evolution in life on the Pacific Islands.

"The project has exceeded expectations in that I have been able to tie in patterns of structure found in other southern hemisphere regions with some of those seen on the Pacific Islands and to connect this, in turn, with the theories of plate tectonics," says Solem.

"Then, stemming from this work, directly and totally unexpectedly, has been a considerable amount of work on fossil land snails and the changing patterns of distribution through time. Here again I have found that change has pretty much proceeded at a snail's pace, rather than showing the rapid patterns of alteration typical of the vertebrate groups in the last few million years."

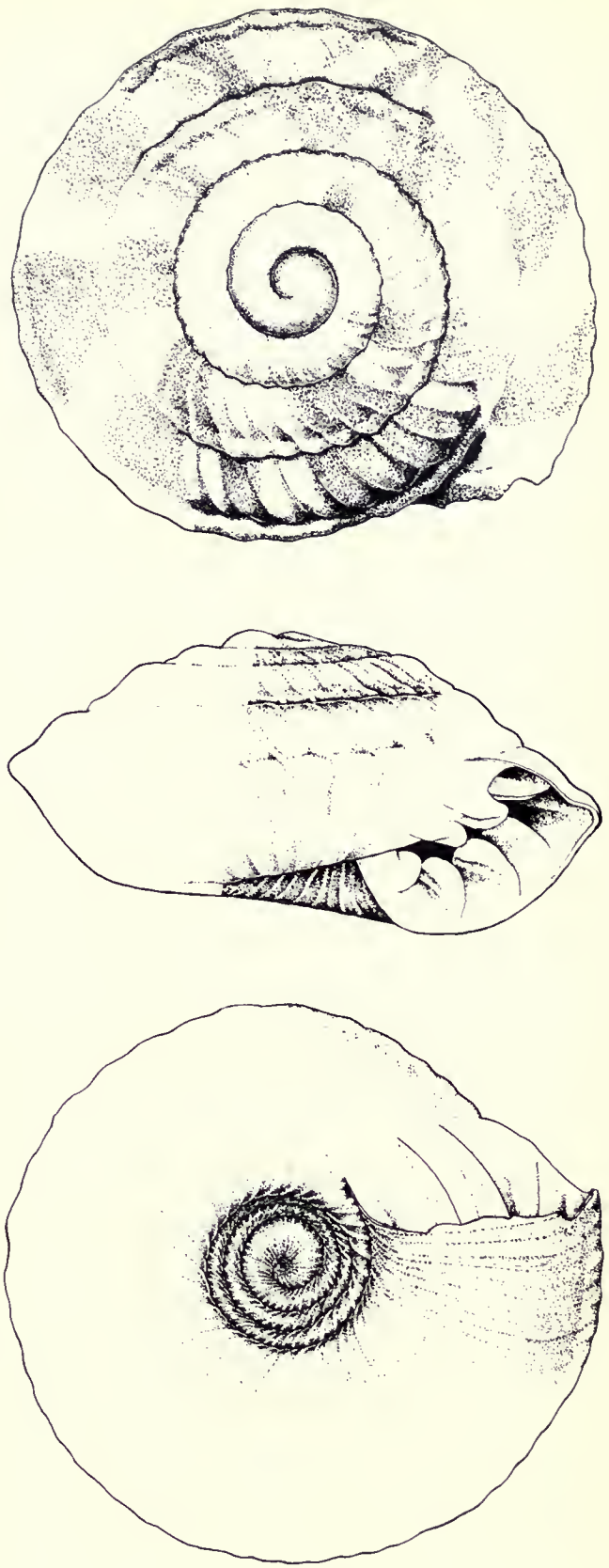
Although overall change has proceeded at a "snail's pace," extinction of taxa has not moved slowly. Most likely a majority of the species recorded in Solem's monograph were wiped out—totally extinct—before he even started work on his project.

As might be expected, man was the causative agent in the extinction of these tiny creatures. Not in any malicious or intentional way—no one said, "Let's bring in the bulldozers and kill off the flora and fauna of these islands." Rather, as Solem explains, "What you had basically was an ecosystem on the Pacific Islands which probably in large part evolved perhaps 200 million years ago, if not earlier, and was both stable and fragile. Utterly without malice of forethought or intention, the introduction of domestic animals and garden plants, with associated insects in the course of perhaps 150 years has virtually wiped out that ecosystem."

It was easily done. For example, because of what Solem calls a "peculiarity of their biology," one of the snail groups was doomed to extinction following the accidental introduction of ants to the Pacific Islands. "The snails have a pattern of laying eggs within the opening of the base of the shell; and there are ants," Solem says, "which are predators throughout the leaf litter where these things live. Thus, even though the adults essentially might not be bothered by the ants, the young would be extremely vulnerable in the egg stage and would very probably have been rapidly wiped out."

"This whole study was possible," Solem continues, "because a man of vision and persistence, the late C. Montague Cooke, Jr. of the Bernice P. Bishop Museum, got interested in land snails in the early 1890s and then, later, was able to sponsor extensive collecting expeditions to various parts of the Pacific. The material that these expeditions brought back provided at least 80 percent of the specimens I was able to study.

"This was an unintentional salvage collecting operation in that if the same effort was expended even in the mid-1950s or early 1960s less than 10 percent of the same quantity of material could have been obtained and today even a smaller fraction. This diminishment is due to the accelerating changes



*Drawings of snail species* Endodonta ekahanuiensis *by Margaret Anne Moran, from Solem's* Endodontoid Land Snails from Pacific Islands.

caused by introduction of various plants and insects that have altered the island environment beyond regeneration."

Although Solem does devote a chapter in his monograph to "Habitat Range and Extinction," that is not the main thrust of the volume. The longest chapter, and the foundation of many of his conclusions, is "Systematic Review." The clear and concise text of the chapter is illustrated by superb line drawings and scanning electron micrographs.

Solem, who pioneered in the use of the scanning electron microscope for studying mollusks, recalls that "for several years I had not worked on certain aspects of the structure of snails because with the optical equipment available the structures were just below the level of what could be seen and I figured there had to be a better way. The moment I saw my first scanning electron microscope photographs I knew the way was there.

"It has really been professionally one of the very fortunate accidents in my life that I had a series of questions in my mind and that the opportunity has been availble not only to answer these but then to see the questions that lay beyond the initial inquiries and to make quantum leaps into the unknown."

After some early experimental work, funded in part by the American Philosophical Society and in large measure by the regular budget of Field Museum, Solem made application to the National Science Foundation for support to establish a scanning electron microscope laboratory at Field Museum. Installation of the equipment was completed in 1973 and the lab has been functioning since that date. Solem has continued to use this instrument as an integral part of his research activities and has now taken some 2,500 micrographs at Field Museum "plus several hundred to a couple of thousand" elsewhere.

His interest in the lab is further demonstrated by the fact that he prepared the museum exhibit "Below Man's Vision" in 1973 and has presented classed in the lab for adults and for advanced high school and beginning college students "with the idea of influencing biologically inclined, bright youngsters at a critical preprofessional career decision phase."

Solem's own preprofessional career decision phase was decidedly affected by curators at Field Museum. When he was about 12 years old he received a box of seashells from an uncle who was stationed on Midway Atoll. Solem consulted a book from his local library, but was unable to find names for many of his shells, so he packed several into a cigar box and, on a Saturday morning, trekked to the Museum with them. He checked out the Museum's shell exhibit and "found to my amazement that I had seashells that the Museum didn't. To this day," Solem says, "I don't know what impelled me to suddenly get magnanimous and go to the receptionist and say 'I'd like to donate these to the Museum. You don't have them' She took my name and address and 10 days later I got a postcard from Fritz Haas (then curator of lower in-

*SEM photos of radular teeth of* Libera fratercula rarotongensis, *from Solem's* Endodontoid Land Snails from Pacific Islands.

vertebrates), thanking me for the gift and pointing out that 99 percent of the Museum's collections weren't on display. Perhaps sometime if I was down at the Museum I'd like to see part of the rest of the collection."

"It was that contact that got me started. I worked as a volunteer first, sometime in insects, sometimes invertebrates, one summer typing file cards for fishes."

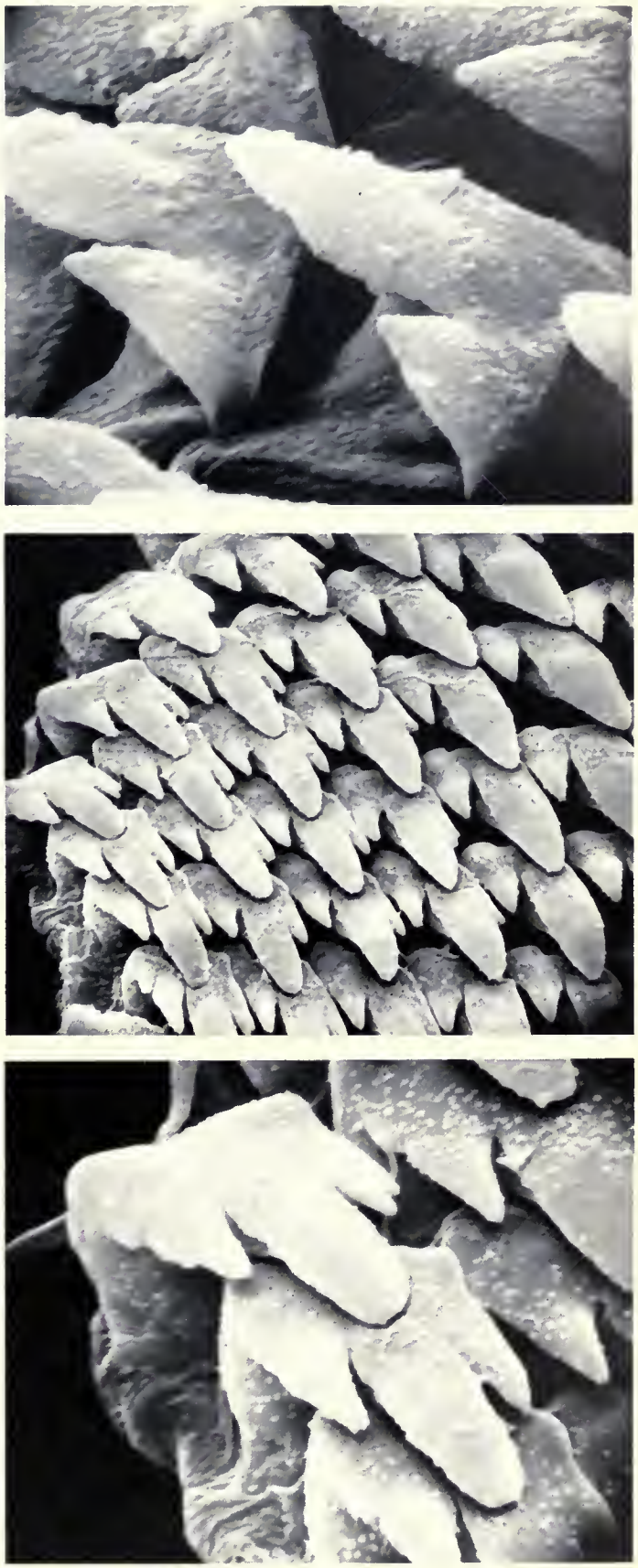
Solem joined the Museum's curatorial staff in 1956 after getting his doctorate at the University of Michigan, Ann Arbor. Since that time he has earned a reputation as an extremely productive and capable scientist. A member of several professional societies, he has had the distinction of presenting papers at several international meetings, has been president of the American Malacological Union and is an editor of two journals. Over the years he has compiled an impressive bibligraphy of both scientific and popular work, including, in 1974, the book *The Shell Makers: Introducing Mollusks.* (Although scientific literature is not known for its wit and humor, Solem did manage to insert in this book the chapter heads "On Becoming Sluggish," "Water and Calcium —The Keys to Slugdom," and, on feeding habits, "To Scrape a Living."

He is now concluding work on Part II of the endodontoid project. It is, naturally, an extension of Part I. Part I provided the methods of analysis and a great deal of descriptive data. Part II adds data from other parts of the world as well as further information on patterns of distribution and, finally, summarizes, drawing everything into a broad, interpretative context. Solem makes comparisons with other groups of organisms and, building on his vast foundation of basic information, advances new theories and tests new ideas in the forthcoming volume.

Completion of this manuscript will not signal a resting point for the malacologist. He is already deeply involved in his next major project—research on semiarid zone land snails of Western and Central Australia. Preliminary field work was done in three months in 1974 and followed by ten months of intensive field work in 1976 to 1977. The two trips netted more than 60,000 specimens and analysis of them is now well underway.

This group of Australian snails shows quite different patterns of speciation and faces very different problems in existence than do the land snails of the Pacific Islands. Further, as Solem explains, "This particular group is apparently near the base of the advanced land snails and through understanding its patterns of distribution and probable evolution I think it will be possible to get a handle on the evolution and thus the pattern of past dispersal of most of the higher land snail groups."

No, writing Parts I and II of Endodontoid Land Snails from Pacific Islands couldn't have been easy, but it appears that, rather than being a unique event in Alan Solem's career, it may well be simply one of his many fine achievements.



*SEM photos of radular teeth of* Libera fratercula rarotongensis, *from Solem's* Endodontoid Land Snails from Pacific Islands.

*D. C. Davies, director of Field Museum 1921-28*

BORDEN EXPEDITION
*Continued from p. 9*

*sun flooding our cabin, I had time to do a water color sketch of the duck before breakfast. It was necessary to moisten the bill, eyes, and feet in order to bring back temporarily faded flesh colors. Later Miss Ames skinned and prepared it for a Museum specimen.*

*May 18: The Nugget Shop [in Juneau] was most interesting to tourists. Mrs. Slaughter bought there an exquisite Attu basket woven by a squaw on Attu Island, one of the Aleutian chain. There are, I believe, only two old women left, at the time of this writing, who will do this fine and beautiful work, so that it is now very rare. Young girls, it is said, will not apply themselves. The baskets ranged in price from fifty to a hundred and fifty dollars, depending on the size and fineness of weave.*

*May 19: The girls were busy that morning washing clothes. The brevity of our stay in the two towns had not permitted us the luxury of having any laundry done. The decks were draped with woolen lingerie, bath towels, and hundreds of pairs of woolen socks. It was great fun, despite aching backs. Pressing with a brand new electric iron amused us, and I think we did a good job. For further exercise we shot clay-pigeons.*

By May 27, the *Northern Light* had reached the southwestern tip of the Alaska Peninsula, where the party was to hunt bear:

*We departed with our kits, guns, and Kodaks. The breakers were too high for the launch to land on the beach, so we were paddled ashore in a dory. The remainder of the morning was occupied in stowing away personal belongings, making preparations for a ten days or three weeks stay.*

*We arrived in camp wearing our heavy Hudson Bay cloth trousers, and rubber boots. An extra forestry cloth shirt, forestry cloth trousers, sweat shirt, pair of high boots, three pairs extra heavy socks, three pairs medium weight socks, and three pairs of soft woolen socks was each person's outfit. Also two pairs of woolen gloves, three sets of heavy woolen underwear, a cotton muffler to wear under the rubber coat, two small towels, one bath towel, and a wash cloth.*

*Oilskins became our most valuable article of clothing as they were worn every day for four weeks. Besides the small necessaries, we had extra sweaters and heavy coats for wear around camp. The only place for the clothes not on our backs was either under the bed, or under the mattress. There was no room for Elizabeth Arden toilet creams, but we thanked our lucky stars for a cream made to soothe tired feet. . . .*

*May 28: Unable to hunt because of the wind, those of us who were left at the base camp did some target-shooting and later in the afternoon fished for a small speckled variety of trout. This gave us our first conception of what hunting bear in Alaska would mean. The ravines and flats were covered with winter-green in berry, and a long willowy yellow grass tripped us up when we least expected. There was not a tree to be seen excepting miles and miles of dwarf alders, a few feet in height. Six miles of tundra lay between camp and the base of the two mountains. Black volcanic ash covered the ground. The twin peaks of Pavlof dominated the landscape, relieving it of a terrible drab monotony by their dazzling whiteness and symmetry. Numberless lakes and ponds spread out over the bleak country and birds were abundant. While fishing, we heard six different tunes, and the birds were so friendly and unafraid we could nearly catch them with our hands. One pair of Alaskan longspurs followed at our heels. Since we had walked over the tundra in heavy rubber boots, that night the foot cream was worth its weight in gold.*

*May 29: Before going to bed we must oil our boots and grease the guns. We were able to warm our tents somewhat by candles, this at least took off some of the dampness. Thank goodness our sleeping bags were adequate and we had the added comfort of a cot and mattress!*

*June 2: When the launch arrived from the yacht the next day, the crew brought us two pails of sea gulls' eggs, greyish green in color and very large, gathered from the rocks*

*on their first day ashore. Surprisingly, they were delicious scrambled! We also received a week's wireless news, and the portable victrola. . . .*

*We had the most romantic looking tents; they resembled those used by Bedouins in the Arabian desert. For practical use, however, in a windy and rainy country, they were useless. We bought them at Abercrombie and Fitch and they were supposed to be the same type as those used by Amundsen. The sides and top leaked at the slightest provocation, and flapped continually. The next time we camp on the Alaskan Peninsula, we shall take only ordinary 8×10 duck tents for sleeping. This type can hold a small stove useful to keep off the continual damp. We shall also carry lighter tents which shed water, and can be used for packing inland for a secondary camp. If planning on a fairly long stay at one camp, we will make arrangements to have a portable house erected before we arrive.*

*Our discomforts in this first camp were chronic. Two mornings I awoke with a foot of water under the cot and rain dripping on my face. We had to watch our rifles constantly to prevent rust.*

*June 3: The dirty weather continued. When my husband returned from his unsuccessful hunting, tired, discouraged, and annoyed, and learned we also had seen no bear, he at once decided to change our hunting country. To add to our dismay, the hunting season was nearly over. Later we discovered that we had never had a fair chance near Pavlof. Another guide with a large party of hunters had already invaded our territory and the game had moved away. Furthermore, the guide responsible for this was in communication with my husband the winter before, and it had been arranged just where each party would hunt.*

*On Sunday, June 5th, after a disappointing week with only one bear bagged, and only two weeks of the hunting season left we broke up our first camp and steamed [sic] into Canoe Bay where my husband had enjoyed better luck in 1916. The entrance of this bay is about 150 yards wide, through which the water seethes in a tide-rip and boils in great whirlpools. Its tremendous force could suck a large vessel below the surface. We waited therefore until ebb tide, which was 5:30, to avoid the bore, and then cautiously headed through the narrow passage. The water was still churning in furious whirlpools. No one spoke. Water slushed and roared on both sides. Finally we passed safely out into the bay. Here we were encircled by snow-covered mountains rising above tiers of brownish hills and flats.*

*"Bear!" rang out from the bow. Hysterical excitement followed—most of us had never even seen an Alaskan brown bear! And there was bruin galloping along the beach, heading away from us as fast as he could. . . .*

*June 21: Mr. Slaughter. . .seemed to have magic about him. Toward the end of the season, after he had the number he wanted, bears seemed to follow him—he spotted one nearly every day with his keen eyesight and never-tiring energy. We figured up the total number seen in all the parties including those spotted by the crew when they went on shore for water, and believe, possibly excepting duplicates, that we saw twenty large bears and seven cubs. . . .*

*We had now to leave our guides at King Cove on the Alaskan Peninsula before we could start off on the third lap of our voyage.*

*June 22: We weighed anchor at five in the morning and stood out of Canoe Bay into the open Pacific bound for King Cove. A fog partially obscured the volcanic and rugged islands which had frowned upon us for four weeks. . . .Mrs. Slaughter and Mrs. Goodspeed arranged their several hun-*

*Stanley Field, president of Field Museum 1908-64*

*dred feet of movie film, Frances Ames pressed many varieties of wild flowers for the Museum, that were just commencing to blossom before we left. I nearly froze my fingers trying to paint three bird sketches on deck.*

*The first two cannery boats of the season came in [to King Cove] after dinner with six hundred salmon. One boat carried an enormous sea lion on its deck. These enormous mammals destroy seines and fish, and when caught they are brought to the canneries as fresh meat for the Aleuts who attack the meat carcass with their knives and effect a roughly equable division on the spot. . . .*

*After luncheon we visited the Aleutian village. So these pitiable people were descendants of the fierce natives of the storm-tossed islands which reach across Bering Sea nearly to Kamchatka, Siberia, when the early English, American, and Russian traders first encountered this new land! It seemed incredible. We had read tales of great sea-otter hunters, fishermen,—people of untold perserverance and energy. And now—they seemed a tragic remnant.*

*June 27: Bering Sea tantalized us. Perhaps because we were happy to be rid of the Pacific—perhaps because it is most certainly tricky navigating. We had turned a corner in our long voyage and were now heading up, up, towards the top of all maps, the Arctic Ocean. . . .The waters we had just left are plyed by occasional cannery-boats and, once a month, a mail-boat; the waters that lay ahead are in these days seldom sailed. This particular summer even the coast-guard cutter* Bear *would not be anywhere near to give assistance; she had been declared obsolete and her successor would not leave San Francisco until too late to be of any use. This (secretly) caused some anxiety, and at the same time offered a bit of glamor; we were to be the first ship north of Nome.*

*Nome's main street, 1927, "paved" with timbers*

*The* Northern Light *in ice floes off the Siberian coast*

On June 28 the *Northern Light* hove into Unalaska Harbor, and the party went ashore.

*June 29: The revenue cutter* Haida *which patrols Bering Sea as far north as the Pribilofs, stood in the harbor the second afternoon, adding greatly to the excitement in Unalaska. The two crews became friendly; the eight sea-scouts were immediately challenged to a game of baseball. Our boys were better sailors than baseball-players; they lost with the score thirteen to six. We regained our laurels however by a wrestling match which Holbrook won with high honors.*

Ordinarily, ships were not permitted to call at the Pribilof Islands, breeding grounds of the fur seal; but the *Northern Light* received special dispensation.

*July 3: When we reached the rocks on which the herd gathers we were terribly disappointed at the comparatively small number we saw; many seals had not yet arrived. [We were] told the females usually come in June. The old bulls return in May and immediately settle themselves on a rock to wait and fight for their harem when the females arrive. The*

*men have even discovered that a bull usually returns to the same rock each year. Bulls, he said, are classified as harem, surplus, and idle. The description was enlightening as to their social activities. Some acquire over a hundred wives, while others manage to hold only five. A few enormous, lonely creatures were patiently waiting for the next delegation of wives from the Pacific Ocean. The females looked so small in comparison, we thought they were young ones until the harem was explained to us. Each lovely brown cow had a tiny black "pup" which she was suckling, and at the same time fanning with her hind-flipper. It was quite a sight, despite our disappointment in the fewer numbers than expected; thousands of absurd fan-like flippers were swishing back and forth from both males and females.*

*The female has one pup every year, giving birth to it shortly after her return to the rookery. She then goes out to sea every few days in search of food. The male, on the other hand, never takes a mouthful of food during the entire breeding season. They say the poor old things look thin and emaciated by the time they start back south on their annual pilgrimage.*

*July 6: At noon when the log was read and our position taken, the trim schooner had sailed two hundred and thirty miles in twenty-four hours, our best record so far. . . . By three o'clock the first mate sighted the shore of St. Lawrence Island.*

*We were off the southwest extremity of the island heading toward the Siberian coast which at one point is only forty miles distant. We were on the west side of the line that runs through the center of Bering Sea—West side. . .Siberia—East side. . .Alaska. It was near here on the Kamchatkan Peninsula, somewhere off the body of water with the beautiful name, the "Gulf of Anadyr," that we had hoped to hunt a rare unclassified sheep for the Museum, but when we left San Francisco no permit had come from Moscow.*

*July 9: As we sailed ahead, we noticed the water was brownish. Captain Joe informed us it was due to the disintegration of thousands of jelly fish on which bow head and other whales feed, swimming with their jaws wide open through a seething mass of these minute objects. Hundreds of birds followed us; the kittiwake was the leader, and there were jaegers and terns.*

*July 11: Plans for the next month changed considerably upon our arrival in Nome. While we were at breakfast the Custom's officer came on board with our mail, and informed us the* Victoria, *on which was coming our guest Mr. T. Ashley Hine, ornithologist of the Field Museum, would not arrive before August 1st, delayed because of her contact with the ice. That meant an Arctic-walrus and polar-bear hunt first,—later returning to Nome for our guest. . . .*

*After much persuasion, it was agreed that two hunters would go with us the following morning into the Arctic. However, we could not know until we saw them arriving, whether they would come or not. Evidently—it was quite an achievement on my husband's part, as these Eskimo have, at times, been roughly treated by hunters, whalers, and moving-picture men, and it was no wonder they hesitated before accepting. Captain Ross explained to us that a gathering of the clan would probably take place in camp that night, and the important question of whether two men should, or should not go, would be discussed until the wee small hours of morning.*

*July 12: But two jolly, good-natured looking natives appeared bright and early. Captain Ross pronounced them "master hunter" of the island and the second best. . . .We called them respectively, Big and Little John. Much to their delight, they were given the cabin belonging to the wireless operator and second engineer, who in turn moved into the room vacated by the Goodspeeds.*

*One of the visitors who came out to say good-by dropped a cheering remark: "Nome has waved good-by to all Bering Sea Arctic expeditions and has watched each one return in part." The women of Nome undoubtedly believed us to be crazy: not one of them had ever ventured into the Arctic.—Many women have visited and hunted in Alaska, but very vew go north of Nome, and none has ever been to Wrangel Island, which lies one hundred miles north of the Siberian coast, and which was now our objective.*

*July 13: In August, 1914, the* Karluk, *of Stefansson's Expedition, commanded by Captain Bartlett, was crushed in the ice about sixty miles north of Wrangel, and the survivors of the disaster wintered on the island, taking possession of it for Canada. They were rescued the following summer. In 1921 Stefansson sent four young men and one Eskimo woman, Ada Blackjack, to live on the island, and hold it for Canada. Because of ice conditions, a relief ship failed to reach them in 1922. Three of the men perished trying to walk across the ice to Siberia, and the fourth, who was left behind, died of scurvy. When the* Donaldson *finally arrived from Nome in 1923 with a new colony of twelve Eskimos and one white man, they found only Ada Blackjack alive. She was taken back to Nome but the colonists bravely remained. The following year the Soviet government sent, on the famous* Red October, *a company of infantry which broke up the colony and carried off the little band of prisoners to Vladivostok. Here the white man died, and the Eskimos later drifted into Manchuria where they were held by the Chinese, and finally repatriated by our government. . . .*

*A year ago Russia announced she was colonizing Wrangel Island but no one had yet seen the colony. Nome awaited our news with interest as the Lomens, the reindeer kings of Nome, had since bought Stefansson's claim to the island.*

*Having read of the adventures and tragedies connected with Wrangel, we hoped desperately to be able to penetrate through fog and ice and reach this thrilling bit of Arctic land.*

*Continuing north the following morning, July 13th, we crossed the Arctic Circle for the third time. A southeasterly breeze sprang up after we passed the Diomedes and the foresail and staysail were set. We sailed before the wind northwest beyond the northeastern point of Asia. By noon we were making twelve knots in the direction of Wrangel Island. Only the fog prevented our seeing the snow-lined coast of*

*The* Northern Light *at anchor off the Alaska coast*

*Siberia. The temperature dropped to 40°.*

*Captain Borden noted in his log: "Told steward to serve glass orange-lime juice to all hands every other day." This was an anti-scorbutic measure. We still had fresh meat, however, as a result of our Nome purchases: chickens, beef, and pork, also fresh fruit and vegetables.*

By July 14, the *Northern Light* had reached Cape Serdzekamen, on Siberia's northern coast. As the schooner slowly approached land, two boatloads of Chukchee, the coastal inhabitants, put out from shore to greet the schooner.

*"Hello" was shouted as the first boat came alongside the yacht. Here were hardy, smiling, brown-skinned people. Beady eyes gleamed at us, coarse black bangs protruded from under their tightly drawn hoods. "Where boat from?" inquired a young, impertinent looking individual. "Ah—Fanshischo—Ah—ha!" he exclaimed knowingly.*

*There were fifty or sixty savages, one of the two hundred or so nationalities formerly ruled by the Czar of all the Russias. Our jolly visitors were clad in shirred garments made from intestines of seal or walrus. . . .No women or girls arrived in the boats. And we were surprised at their healthy, robust appearance after the description given by our King Island natives. They wanted to trade, and when we refused because of having no permission from the Russian government, they were obviously disappointed. However we did give them some tobacco, tea, sugar, flour, and a few cartridges, receiving in return broad smiles of gratitude and bits of old ivory which were taken out of their hair-seal bags and thrown on the deck of the* Northern Light.

*July 15: When they returned the following morning with their wives and children we gave more presents. The feminine members of the visiting party were suspicious of us and screamed every time we attempted to take their pictures: one old hag pointed at a wooden carving she wore around her neck, seeming to threaten us with Evil Demons.*

*Surprisingly—a white man was with the Chukchees this time. He was also dressed in a reindeer skin* parka, *and by his side leaned his half-breed daughter, a very pretty fifteen year old girl. Wall was a Norwegian who had traded without a license near Cape Serdze for more than twenty years. Recently the Soviets fined him five thousand dollars, and confiscated his trade-goods and schooner. To cap the climax, both his hands were accidently blown off by dynamite, and he became dependent on his Chukchee wife and family. Wall told us he had hopes of getting his papers and being able to leave for the States as soon as possible if a ship would pick him up later in the summer. When he said his daughter would go with him, I gave her a pair of stockings, brown leather oxfords, and a woolen dress. Her pinched white face was pitiful to watch when she looked at the dress, and clutched with eager childish hands the new shoes.*

*"And to think we have ever complained when you see people like that!" exclaimed the steward, as he too leaned over the rail and watched the boatloads of people.*

The account of the Borden-Field Museum Expedition will be concluded in the January, 1979, *Bulletin*.

*Chukchee boys mug for camera.*

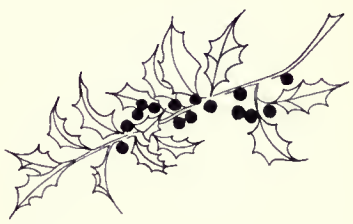
# *For Christmas, "Give Field Museum"*

*Whether you are trying to decide on a Christmas gift for the small child or for "the man who has everything," a gift of membership in Field Museum is always appropriate. And for the budget-minded shopper it's one of those unusual finds — a gift that costs no more than it did a few years ago!*

*For the adult, a membership provides a wealth of opportunities to further explore the realm of natural history; for the child it can open the doors to a lifetime of scientific interest or professional endeavor. Infinitely more than a storehouse of fascinating specimens and exhibits, Field Museum offers to its members at every age level a varied selection of exciting learning experiences via the classroom, workshop, film, or field trip.*

*Perhaps equally important: with a Field Museum membership you are giving a shared relationship, for Field Museum is indeed its members.*

**Clip and mail this coupon or facsimile**



to: Field Museum of Natural History
Roosevelt Road at Lake Shore Drive
Chicago, Ill. 60605

I wish to send gift memberships to the following:

| | | |
|---|---|---|
| Gift recipient's name | Gift recipient's name | My name |
| Street | Street | Street |
| City State Zip | City State Zip | City State Zip |
| ☐ *Annual $15* ☐ *Life $500* | ☐ *Annual $15* ☐ *Life $500* | ☐ *Check enclosed payable to Field Museum*<br>☐ *Please bill me*<br>☐ *Send gift card announcement in my name* |

*Continued from page 3*

### Blackmon Heads Education Department

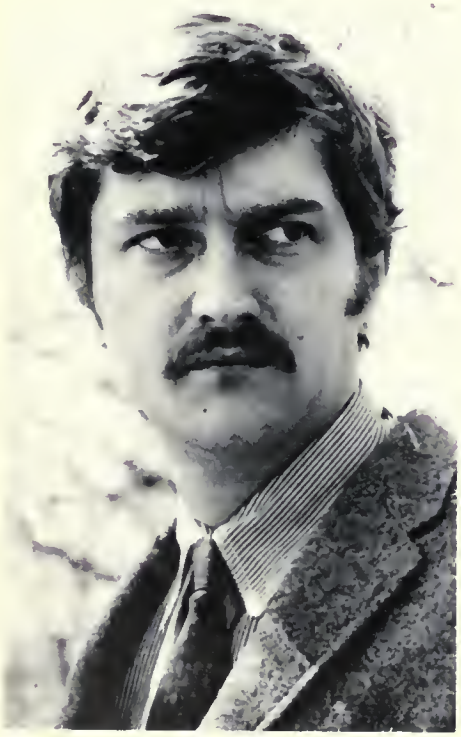
Carolyn P. Blackmon, acting chairman of the Department of Education, has been named chairman. Mrs. Blackmon joined the department in 1971 as acting coordinator of Harris Extension and audiovisual services. Subsequently she was coordinator of special educational services, head of program development, and head of public programs. She also served as coordinator of the volunteer programs.

Mrs. Blackmon holds a B.S. from Bradley University. She is a native of Peoria, Ill., and currently resides in Chicago.

### Lecture on Indian Dwellings

"Houses of Native America: Structural Variety and Cultural Interpretation" is the title of a slide lecture to be given by Peter Nabokov in James Simpson Theatre on Friday, Nov. 17, at 7:00 p.m. The lecture is the outgrowth of Nabokov's research and fieldwork on American Indian dwelling types—believed to be the most thorough such study since that of Lewis Henry Morgan, nearly a century ago. The lecture is open to the public and is free.

*Peter Nabokov*



*Roman cinerary urn, first century A.D., on view in Hall L.*

### Paleontologist Larry Marshall Awarded National Geographic Society Grant

Larry G. Marshall, visiting assistant curator of geology, has been awarded a research grant by the National Geographic Society in the amount of $7,952 for the project "Search for Cretaceous Mammals and Magnetostratigraphy of Cretaceous-Tertiary Boundary in South America." In December he will leave the Museum for two months to conduct his research in Chubut Province, southern Argentina. Assisting in the research will be Robert F. Butler, associate professor of geosciences at the University of Arizona, Tucson. The area under study was worked in 1923 by the late Elmer S. Riggs, former curator of paleontology at Field Museum.

### As for Pompeii . . .

The Roman and Etruscan permanent exhibit, featuring the finest specimens in the Museum's collection, may now be viewed in the refurbished surroundings of Hall L. Many of the pieces here were contemporary with the A.D. 79 eruption of Mt. Vesuvius and the burying of Pompeii. They come from Boscoreale, a farming villa only a couple of kilometers north of Pompeii and actually on the slopes of Vesuvius. There are many examples of fresco wall paintings, bronze tables, bathtubs, household utensils such as dinnerware, pitchers, and lamps; hoes, shovels, rakes, pitchforks, and millstones are also on view.

Dating from the seventh to the third century B.C., the Etruscan collection is comprised mainly of articles buried in tombs from different parts of Tuscany, then known as Etruria. The entire range of burial containers is represented, from cremation urns to the elaborate couch and sarcophagus types. Some of the graceful black Bucchero vases and cups on exhibit show the refinement of Etruscan art. Bronze toilet and household articles were luxuries which the Etruscans exported to Greece. These were of such unrivalled perfection that Critias the Tyrant praised "all the bronzes of Etruria which are the ornament of the house, whatever use is made of them."

Most of the Roman-Etruscan collection pieces were collected by the Museum's first president, Edward E. Ayer. Since he was able to purchase only a small number of original Pompeiian bronzes, he commissioned the bronze-casting firm of Sabatini and Sons, in Naples, to make copies of originals in the Naples National Museum. The reproductions are faithful to the smallest detail, and it is next to impossible to distinguish the originals from the copies. Only the maker's label, set inconspicuously into the bottom, or refined chemical analysis, can reveal the true nature of the reproduction. These, as well as original pieces from Pompeii, may be seen in Hall L.

*—Joyce A. Korbecki, scientific assistant, Department of Anthropology.*

# November & December at Field Museum

*(November 15 through December 15)*

### New Exhibits

**Rails of the World.** November 11—January 28, 1979. An exhibition of 42 watercolors, painted by J. Fenwick Lansdowne, represents the little-known bird family of Rallidae. The exhibition is part of a national tour organized by the Smithsonian Institution Traveling Exhibition Service (SITES). A combination of art, science, and artistic realism, the works were painted to illustrate the book *Rails of the World*, by S. Dillon Ripley, Secretary of the Smithsonian. Hall 21.

**A Stamp Sampler: Postage from Natural History.** Opens December 8. This new exhibit unites 63 natural history specimens with samples of philatelic art. Planned on a rotating basis to cover the four disciplines of natural history, the first 8 months of the exhibit will be devoted to zoological specimens and their representations on stamps from all over the world. "A Stamp Sampler" was conceived by Field Museum volunteer Colonel M. E. Rada, who is guest curator for the exhibit. The exhibition was designed by Peter Ho, a University of Illinois graduate student.

### Continuing Exhibits

**Cash, Cannon, and Cowrie Shells:** The Nonmodern Moneys of the World. A fascinating collection that contains over 80 varieties of money used by ancient cultures of the world. It explores the origins, values, and meaning of nonmodern money in terms of buying power for these past civilizations. The accompanying text gives the value of each form of money in terms of how much food it could buy in ancient times. Four general categories of nonmodern moneys are on display: metal coinage, uncoined metal, shell money, and "miscellaneous," which includes currencies made of food, fur, fiber, glass, teeth, and stone. No closing date. Between Halls K and L, ground floor.

**Field Museum Gamelan.** Field Museum's 19th-century Javanese gamelan, ensemble of 24 fine bronze and wood musical instruments, has been completely restored for exhibition. It is the oldest and perhaps finest gamelan outside Indonesia. Hall K, ground floor.

**Pawnee Earth Lodge.** This exhibit, in Hall 5, is a traditionally made Pawnee earth lodge—the home and ceremonial center of Pawnee Indians as it existed in the mid-1800s. Daily programs provide the opportunity to learn about Pawnee culture. Public program hours: Monday through Friday, 1:15 p.m.; weekends, 11:00 a.m. and 1:15 p.m. Tickets may be obtained during the hour prior to the program at the North Information Booth. Programs limited to 30 people.

**The Place for Wonder.** This gallery provides a place to handle, sort, and compare artifacts and specimens. Weekdays, 1 p.m. to 3 p.m.; weekends, 10 a.m. to noon and 1 p.m. to 3 p.m. Ground floor, near central elevator.

### New Programs

**Houses of Native America:** Structural Variety and Cultural Interpretation. Lecture. November 17 at 7:00 p.m., James Simpson Theatre. Presented by Peter Nabokov, this free slide lecture examines the symbolic, cultural, and practical significance of American Indian dwelling types. The stimulating program is highly recommended for those who desire more information about Field Museum's extensive Native American collection on exhibition. The program is funded by the Edward E. Ayer Foundation.

**Film Premiere:** Leon Mandel 1941 Zoological Expedition to the Galapagos. December 2 and 3, 1:30 p.m., James Simpson Theatre. Free at the West Entrance of the Museum. This documentary film, narrated by Loren Woods, curator emeritus of fishes, and member of the expedition, traces an exotic journey to the remote Galapagos Islands. The film captures man-of-war birds, boobies, albatross, iguanas, sea turtles, and sea lions in their natural habitats. One filmed sequence shows pre-scuba diving equipment being used to explore the Galapagos waters.

*Calendar continued on back cover*

# November & December at Field Museum

*(CALENDAR continued from inside back cover)*

**Festival of International Music and Dance Series:** December 4, 8:00 p.m., James Simpson Theatre. "An Evening of African Mbira Music and Improvisation on African Themes." Paul Berliner, director, and the group Kudu, will perform the final program in the "International Festival of Music and Dance," sponsored by Field Museum. Berliner will perform on the mbira, or thumb piano, and his group Kudu will play Berliner's original works for mbira, kudu horn, trumpet, flugelhorn, string bass, drums, and other percussion. Admission: members, $5.00; non-members, $6.00. Members' dinner: at 6:00 p.m., $7.50 each.

**Winter Journey:** "American Indian Dwellings." December 1 through February 28. This self-guided tour for families and children describes different types of American Indian homes found on the main floor of the Museum. Free *Journey* pamphlets are available at the North Information Booth, and at the South and West doors.

"Takahe," watercolor by J. Fenwick Lansdowne. Exhibit of this and 41 other paintings—"Rails of the World"—by renowned Canadian artist opens Nov. 11 in Hall 21.

**Edward E. Ayer Film Lectures** are scheduled on Saturdays through November at 2:30 p.m., James Simpson Theatre. Reserved seating is available for members and their families. Doors open at 1:45 p.m.

Nov. 18: "Puerto Rico," by John W. Roberts

Nov. 25: "Grand Canyon by Dory," by Martin Litton

### Continuing Programs

**Fall Journey for Children:** "Journey into the World of Money." Through November 30. This tour explains what today's dollar could be exchanged for in an ancient Aztec city, Iroquois village, or Chinese metropolis.

**Friend or Foe? The Natural History Game.** Field Museum's popular "Anthropology Game" has been expanded to include botany, geology, and zoology. The object here is to determine which one of a pair of apparently similar specimens is harmful and which is not. See if you can distinguish a vampire bat, a headhunter's axe, a poisonous mineral, or a deadly mushroom from its benign look-alike. Ground floor; no closing date.

**On Your Own at Field Museum.** Self-guided tour booklets, adult- and family-oriented, are available for 25¢ each at the entrance to the Museum Shop, main floor north.

**Weekend Discovery Programs.** Guided tours, demonstrations, and participatory activities. Every Saturday and Sunday, 10 a.m. to 3 p.m.

**Volunteer Opportunities.** Limited opportunities are available in botany, geology, and zoology. Weekend volunteers with an interest in natural history are needed to develop and present weekend programs. For more information call 922-9410, ext. 360.

**Adult Group Programs** provide an opportunity to attend special slide programs and tours of selected exhibits. Arrangements can be made to dine in one of the Museum's private dining rooms. Fall-Winter Programs include "Life in Ancient Egypt"; "The Weaver's Walk"; and "The American Plains Indian." For more information call (312) 922-0733.

**November and December Hours.** The Museum opens daily at 9 a.m. and closes at 4 p.m. Mondays through Thursdays. On weekends the Museum is open from 9 a.m. to 5 p.m. On Fridays the Museum remains open until 9 p.m. throughout the year.

**The Museum Library** is open weekdays 9 a.m. to 4 p.m. Closed Thanksgiving. Obtain a pass at the reception desk, main floor.

*Museum telephone: (312) 922-9410*

December
1978

# Field Museum of Natural History Bulletin

**Field Museum of Natural History Bulletin**

December, 1978
Vol. 49, No. 11

*Editor/Designer:* **David M. Walsten**
*Production:* **Oscar Anderson**
*Calendar:* **Mary Cassai**
*Staff photographer:* **Ron Testa**

**Field Museum of Natural History**
Founded 1893

*President and Director:* **E. Leland Webber**

BOARD OF TRUSTEES

William G. Swartchild, Jr., *chairman*
Mrs. T. Stanton Armour
Goerge R. Baker
Robert O. Bass
Gordon Bent
Harry O. Bercher
Bowen Blair
Stanton R. Cook
O. C. Davis
William R. Dickinson, Jr.
Thomas E. Donnelley II
Marshall Field
Nicholas Galitzine
Paul W. Goodrich
Hugo J. Melvoin
William H. Mitchell
Charles F. Murphy, Jr.
James J. O'Connor
James H. Ransom
John S. Runnells
William L. Searle
Edward Byron Smith
Robert H. Strotz
John W. Sullivan
Mrs. Edward F. Swift
Edward R. Telling
Mrs. Theodore D. Tieken
E. Leland Webber
Julian B. Wilkins
Blaine J. Yarrington

LIFE TRUSTEES

William McCormick Blair
Joseph N. Field
Clifford C. Gregg
Samuel Insull, Jr.
William V. Kahler
Remick McDowell
James L. Palmer
John T. Pirie, Jr.
Donald Richards
John M. Simpson
J. Howard Wood

*Field Museum of Natural History Bulletin* is published monthly, except combined July/August issue, by Field Museum of Natural History, Roosevelt Road at Lake Shore Drive, Chicago, Il. 60605. Subscriptions: $6 a year; $3 a year for schools. Museum membership includes *Bulletin* subscription. Opinions expressed by authors are their own and do not necessarily reflect the policy of Field Museum. Unsolicited manuscripts are welcome. Postmaster: Please send form 3579 to Field Museum of Natural History, Roosevelt Road at Lake Shore Drive, Chicago Il. 60605. ISSN: 0015-0703. Second class postage paid at Chicago, Il.

CONTENTS

3 **Feather Arts: Beauty, Wealth, and Spirit from Five Continents**
Exhibit opens February 15
*By Phyllis Rabineau, custodian of collections, Department of Anthropology*

4 **Appointment Calendar for 1979**
Features photos of featherwork from around the world
*Photos by Ron Testa*

back cover **December and January at Field Museum**
Calendar of coming events

## COVER

Hawaiian effigy. Red and yellow feathers, too powerful for common men to touch, were used in this effigy of Kukailimoku, the "land-grabber," war god of Hawaii. This and other featherwork were made by aristocratic men, and were used only by nobility. Effigies like this were carried into battle by powerful rulers. This object may have been originally collected by Capt. James Cook (1728-79); in any event, it was certainly made before 1800. Acquired from the collection of Capt. A. W. F. Fuller. Height 27 cm. Cat. 272591. This piece and some 260 other examples of featherwork will be on exhibit in Hall 26 beginning February 15. Members' preview February 14. Photo by Ron Testa.

*Ron Testa, Field Museum photographer, looks on while Phyllis Rabineau, custodian of the anthropology collection, adjusts feather headdress made by the Jivaro, a Brazilian tribe. Photo by Fleur Hales, Division of Photography.*

# Feather Arts: Beauty, Wealth and Spirit

## Exhibit opens February 15 in Hall 26

*BY* PHYLLIS RABINEAU

Featherwork is the unique medium of this temporary exhibit, possibly the most unusual—and arresting—assemblage of art objects ever exhibited in a major natural history museum. Two hundred sixty works from five continents are represented, some contemporary, others as much as 1,000 years old.

The cultural contexts of the artifacts and their visual qualities cover a range as broad as their geographic distribution—from the theatricality of dance costuming to the intimacy of jewelry and religious offerings. In five theme areas, the exhibit considers the diversities of crafting technique and utilization.

**About feathers.** To fully appreciate the craft of featherworking we must first examine the physical properties of the medium. Some of these properties—color and texture, for example—are easily visible. To recognize others, such as material strength and flexibility, we turn to photographs made with the scanning electron microscope. Finally, we look at how the various characteristics of feathers have been put to practical use—such as in fishing lures, arrow fletching, and birdskin clothing, which is an ancient arctic technique whose modern descendant is the down-filled parka.

**How to feather.** This section juxtaposes objects from all over the world, showing the techniques which have been devised to utilize in art works the natural shapes, textures, and rich colors of the medium. Some techniques are simple appropriations of plumage—glued to the wearer's body or tied to the hair. Other techniques, involving cutting, weaving, or mosaic inlaying, often result in complex structures. Some of the outstanding objects exhibited here include an African dance costume covered with wild fowl plumage, delicate iridescent feather baskets made by the Pomo Indians of California, 19th-century Chinese feather jewelry, Plains Indian ceremonial objects made from entire wings, and colorful South American costumes employing birdskin mosaics on cloth made of bark.

**Beauty.** In human societies, feather ornaments serve many purposes. They may be displays of wealth or be costuming that is required for religious events. Often, however, their purpose is to satisfy the simple desire to look beautiful, to attract the opposite sex; in this we behave very much like the birds themselves, whose displays of plumage are courtship overtures. This exhibit section shows how styles of feather ornamentation vary from culture to culture: the bold play of color and form in New Guinea, the delicacy and chromatic subtlety of Brazilian Indian work.

**Wealth.** Valued for their rarity, beauty, and fragility, feathers were a form of wealth in many countries. Feather money is still used by some peoples, although for others the ancient valuables have long since been replaced by modern mediums of exchange. The use of feathers as wealth is illustrated with objects such as Hawaiian and Maori clothing and with feather currency from North America, South America, and the Pacific.

**Spirit.** When we examine the cultural meaning of feather arts, we often find that they were used on occasions when people sought assistance from spiritual powers, in ceremonies of worship or in warfare. There are several reasons why feathers are "spirit matter," but certainly the most important is that they serve to invoke the special power of birds — flight that takes them to the heavens where the spirits dwell. The religious meaning of feather arts is examined with materials as diverse as a Plains Indian eagle feather warbonnet, a pair of sorcerer's feather shoes from Australia, headdresses from South American drug-related rituals, and feather wands used by shamans to expunge illness from a patient's body.

Although feather arts are made everywhere, this is the first major travelling exhibit devoted to this medium. Those of us involved in its preparation have enjoyed discovering the wonderful creativity which peoples in many cultures have demonstrated in making these objects. We invite you to share in this discovery. □

---

*Phyllis Rabineau, custodian of the anthropology collections, is curator of the exhibit, "Feather Arts: Beauty, Wealth, and Spirit." Exhibit and catalog designer: Clifford Abrams; exhibit conservator: Shauna Clark; exhibit and catalog editor: Patricia Williams; exhibit catalog photographer: Ron Testa. A color catalog of the exhibit, price to be announced, will be available.*

Kingfisher feather ornament, Ming dynasty (1368–1644). This ornament represents a bird—perhaps a phoenix—and

The use of feathers in jewelry was recorded in China as early as the Tang dynasty.

**Woman's hairpin.** *China. This ornament represents a bird—perhaps a phoenix—and was made by inlaying pieces of brilliant blue kingfisher feathers in a metal support.*

*The use of feathers in jewelry was recorded in China as early as the T'ang dynasty. Probably 19th century. Length 8 cm. Cat. 234891.*

# January 1979

## *Field Museum of Natural History*

| SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|
| *Visit Pawnee Earth Lodge open daily* | 1 NEW YEAR'S DAY Museum Closed | 2 *Register now for winter adult education courses* | 3 | 4 *Quadrantid meteor shower (100/hr). Earth in perihelion (91.4 million miles from sun)* | 5 first quarter | 6 |
| 7 Julian calendar Christmas | 8 | 9 | 10 *Roger Payne film lecture: "Among Wild Whales" 8:00 p.m. Simpson Theatre* | 11 | 12 | 13 full moon |
| 14 *Discovery programs every Saturday and Sunday* | 15 | 16 *Winter adult education courses begin* | 17 *Winter adult education courses begin* | 18 *Winter adult education courses begin* | 19 | 20 |
| 21 last quarter *"Under Coyote's Eye: A Play about Ishi" 2:00 p.m.* | 22 | 23 | 24 | 25 | 26 | 27 |
| 28 new moon *Last day to view "Rails of the World" Hall 21* | 29 | 30 | 31 | | | |

DECEMBER

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | | | | 1 | 2 |
| 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | | | | | | |

FEBRUARY

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 |
| 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| 25 | 26 | 27 | 28 | | | |

*Paraguay. This armband, probably worn by a man, features long egret plumes; 19th century. Diam. 18 cm. Cat. 11414.*

# February 1979

# *Field Museum of Natural History*

| SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|
| JANUARY<br>S M T W T F S<br>1 2 3 4 5 6<br>7 8 9 10 11 12 13<br>14 15 16 17 18 19 20<br>21 22 23 24 25 26 27<br>28 29 30 31 | MARCH<br>S M T W T F S<br>1 2 3<br>4 5 6 7 8 9 10<br>11 12 13 14 15 16 17<br>18 19 20 21 22 23 24<br>25 26 27 28 29 30 31 | | *Visit Pawnee Earth Lodge open daily* | 1 | 2 Ground-hog Day | 3 *Discovery programs every Saturday and Sunday*<br>first quarter |
| 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11<br>full moon | 12 Lincoln's Birthday | 13 | 14 Valentine's day<br>*"Feather Arts: Beauty, Wealth, and Spirit from Five Continents" Members' preview* | 15<br>*"Feather Arts: Beauty, Wealth, and Spirit from Five Continents" opens to public* | 16 | 17 |
| 18 | 19 President's day*<br>last quarter | 20 | 21 | 22 Washington's birthday* | 23 | 24 |
| 25 | 26<br>*Solar eclipse (total in NW states)*<br>new moon | 27 Shrove Tuesday | 28 Ash Wednesday | *The observance of George Washington's birthday as a legal holiday on Feb. 22 began in 1796. In many states, however, his birthday is now celebrated on the 3rd Monday of February, designated Presidents' Day. | | |

Mat. Eskimo, Sukkertoppen, west Greenland. Birdskin mats were an early tourist

**Mat.** *Eskimo, Sukkertoppen, west Greenland. Birdskin mats were an early tourist trade item made by Greenland Eskimos. The technique, however, has roots in traditional arctic clothing made from duck skins, a material which is warm, lightweight, and water repellent; 1920s; 80 x 70 cm. Cat. 176180.*

# March 1979

# *Field Museum of Natural History*

| SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|
| FEBRUARY<br>S M T W T F S<br>1 2 3<br>4 5 6 7 8 9 10<br>11 12 13 14 15 16 17<br>18 19 20 21 22 23 24<br>25 26 27 28 | APRIL<br>S M T W T F S<br>1 2 3 4 5 6 7<br>8 9 10 11 12 13 14<br>15 16 17 18 19 20 21<br>22 23 24 25 26 27 28<br>29 30 | | *Visit Pawnee Earth Lodge open daily* | 1 | 2 | 3<br>*"Venezuela: Land of Natural Wonders" by George Lange. Ayer illustrated lecture 2:30 p.m.* |
| 4<br>*Discovery programs every Saturday and Sunday* | 5<br>first quarter | 6 | 7 | 8 | 9 | 10<br>*"Russia" by Dick Reddy. Ayer illustrated lecture 2:30 p.m.* |
| 11 | 12 | 13<br>*Partial lunar eclipse*<br>full moon | 14 | 15 | 16 | 17<br>St. Patrick's Day<br>*"Sweden—A Midsummer's Dream" by Ric Dougherty. Ayer illustrated lecture 2:30 p.m.* |
| 18 | 19 | 20 | 21<br>last quarter | 22 | 23 | 24<br>*"Germany—Once upon a Time" by Kathy Dusek. Ayer illustrated lecture 2:30 p.m.* |
| 25 | 26 | 27<br>new moon | 28 | 29 | 30 | 31<br>*"Egypt: Gift of the Nile" by Doug Jones. Ayer illustrated lecture 2:30 p.m.* |

**Man's headdress.** *Tapirapé, Brazil. Spoonbill feathers provide an upright form for this mosaic of brilliant color. 1960s. Diameter 20 cm; height 36 cm. Cat. 155147.*

# April 1979

# *Field Museum of Natural History*

| SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|
| 1 *Discovery programs every Saturday and Sunday* | 2 *Register now for environmental field trips* | 3 | 4 first quarter | 5 | 6 | 7 *"China after Mao" by Jens Bjerre. Ayer illustrated lecture 2:30 p.m.* |
| 8 Palm Sunday | 9 | 10 | 11 | 12 Passover full moon | 13 Good Friday | 14 *"The Marsh—A Quiet Mystery" by Tom Sterling. Ayer illustrated lecture 2:30 p.m.* |
| 15 Easter | 16 | 17 *Spring adult education courses begin* | 18 *Spring adult education courses begin* | 19 last quarter *Spring adult education courses begin* | 20 Eastern Orthodox Holy Friday | 21 *Lyrid meteor shower (15/hr)* *"O Canada" by Ken Richter. Ayer illustrated lecture 2:30 p.m.* |
| 22 Eastern Orthodox Easter | 23 | 24 | 25 | 26 new moon | 27 | 28 *"Discover Japan" by Ted Bumiller. Ayer illustrated lecture 2:30 p.m.* |
| 29 | 30 | *Visit Pawnee Earth Lodge open daily* | | | | |

MARCH

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 |
| 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| 25 | 26 | 27 | 28 | 29 | 30 | 31 |

MAY

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| 27 | 28 | 29 | 30 | 31 | | |

**Cloak** (*ie'tuli*). Maori, New Zealand. In the 19th century, feather cloaks were a valuable possession, symbolic of high status, for the Maori of New Zealand. This example uses various imported feathers such as peacock and pheasant. Early 20th century; 1 m x 1.4 m. Cat. 88521.

# May 1979

## *Field Museum of Natural History*

| SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|
| APRIL<br>S M T W T F S<br>1 2 3 4 5 6 7<br>8 9 10 11 12 13 14<br>15 16 17 18 19 20 21<br>22 23 24 25 26 27 28<br>29 30 | JUNE<br>S M T W T F S<br>1 2<br>3 4 5 6 7 8 9<br>10 11 12 13 14 15 16<br>17 18 19 20 21 22 23<br>24 25 26 27 28 29 30 | 1<br>*"Huichol" opens* | 2 MEMBERS' NIGHT<br>*open house for members*<br>Museum's present building formally opened 1921 | 3 MEMBERS' NIGHT<br>*open house for members*<br>first quarter | 4 MEMBERS' NIGHT<br>*open house for members*<br>*Eta Aquarid meteor shower (18/hr)* | 5<br>*Environmental field trips begin* |
| 6<br>*Environmental field trips begin* | 7 | 8 | 9 | 10 | 11<br>full moon | 12 |
| 13 Mother's Day | 14 | 15 | 16 | 17 | 18<br>last quarter | 19 |
| 20<br>*Venus in conjunction with Mars* | 21 | 22 | 23 | 24 | 25<br>new moon | 26 |
| 27 *Discovery programs every Saturday and Sunday* | 28 MEMORIAL DAY | 29 | 30 | 31 | | *Visit Pawnee Earth Lodge open daily* |

**Headband.** *Napa, California. Headbands made from crests of the pileated woodpecker are a traditional form of wealth among Indian tribes of northern California. They are worn in the Jumping Dance, a ceremony celebrating the harvest of acorns and salmon and revitalizing the earth; 19th century; 51 x 25 cm. Cat. 57673.*

# June 1979

## *Field Museum of Natural History*

| SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|
| MAY<br>S M T W T F S<br>1 2 3 4 5<br>6 7 8 9 10 11 12<br>13 14 15 16 17 18 19<br>20 21 22 23 24 25 26<br>27 28 29 30 31 | JULY<br>S M T W T F S<br>1 2 3 4 5 6 7<br>8 9 10 11 12 13 14<br>15 16 17 18 19 20 21<br>22 23 24 25 26 27 28<br>29 30 31 | | | *Visit Pawnee Earth Lodge open daily* | 1<br>*Summer Journey: self-guiding tour* | 2<br>*Exhibit "Treasures of Cyprus" opens*<br>first quarter<br>Field Museum first formally opened 1894 |
| 3<br>Pentecost | 4 | 5 | 6 | 7 | 8 | 9<br>*Discovery programs every Saturday and Sunday* |
| 10<br>full moon | 11 | 12 | 13 | 14<br>Flag Day | 15 | 16 |
| 17<br>Father's Day<br>last quarter | 18 | 19 | 20 | 21 | 22 | 23 |
| 24 | 25 | 26 | 27 | 28 | 29 | 30 |

**Man's headdress.** *Karajá, Brazil. A conical wood framework supports this traditional headdress. The bright splashes of color are macaw feathers. Twentieth century. Diameter 17 cm; height 32 cm. Cat. 155146.*

# July 1979

## *Field Museum of Natural History*

| SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|
| 1 | 2 first quarter | 3 *Earth in aphelion (94.5 million miles from sun)* | 4 INDEPENDENCE DAY | 5 | 6 | 7 *Discover program every Saturda and Sunda* |
| 8 | 9 full moon | 10 | 11 | 12 | 13 | 14 |
| 15 | 16 last quarter | 17 | 18 | 19 | 20 | 21 |
| 22 | 23 new moon | 24 | 25 | 26 | 27 | 28 |
| 29 | 30 *Delta Aquarid meteor shower* | 31 | *Visit Pawnee Earth Lodge open daily* | | | |

JUNE

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | | | | 1 | 2 |
| 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| 24 | 25 | 26 | 27 | 28 | 29 | 30 |

AUGUST

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 |
| 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 19 | 20 | 21 | 22 | 23 | 24 | 25 |
| 26 | 27 | 28 | 29 | 30 | 31 | |

**Basket.** *Yokuts, California. Bottle-necked baskets, often decorated with quail plumes, held rattlesnakes used in religious ceremonies by Indians of eastern California; 19th century. Diameter 50 cm; height 22 cm. Cat. 70352.*

# August 1979

## *Field Museum of Natural History*

| SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|
| JULY<br>S M T W T F S<br>1 2 3 4 5 6 7<br>8 9 10 11 12 13 14<br>15 16 17 18 19 20 21<br>22 23 24 25 26 27 28<br>29 30 31 | SEPTEMBER<br>S M T W T F S<br>1<br>2 3 4 5 6 7 8<br>9 10 11 12 13 14 15<br>16 17 18 19 20 21 22<br>23 24 25 26 27 28 29<br>30 | | 1<br>first quarter<br>*Register now for environmental field trips* | 2 | 3 | 4<br>*Discovery programs every Saturday and Sunday* |
| 5 | 6 | 7<br>full moon | 8 | 9 | 10 | 11<br>*Perseid meteor shower (65/hr)* |
| 12 | 13 | 14<br>last quarter | 15 | 16 | 17 | 18 |
| 19 | 20 | 21 | 22<br>new moon | 23 | 24 | 25 |
| 26 | 27 | 28 | 29 | 30<br>*Jupiter in conjunction with Mercury*<br>first quarter | 31 | *Visit Pawnee Earth Lodge open daily* |

**Headband.** *Jivaro, Peru. Internal trading among Peru's Jivaro tribe sees the exchange of salt and rifles for highly valued red and yellow toucan feathers. These are then fashioned into headbands, earrings, and other ornaments; 20th century; 45 x 16 cm. Cat. 193969.*

# September 1979

## *Field Museum of Natural History*

| SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|
| AUGUST<br>S M T W T F S<br>1 2 3 4<br>5 6 7 8 9 10 11<br>12 13 14 15 16 17 18<br>19 20 21 22 23 24 25<br>26 27 28 29 30 31 | OCTOBER<br>S M T W T F S<br>1 2 3 4 5 6<br>7 8 9 10 11 12 13<br>14 15 16 17 18 19 20<br>21 22 23 24 25 26 27<br>28 29 30 31 | | | | *Visit Pawnee Earth Lodge open daily* | 1<br>*Fall Journey: self-guiding tour* |
| 2<br>*Discovery programs every Saturday and Sunday* | 3<br>LABOR DAY | 4 | 5 | 6<br>*Total lunar eclipse*<br>full moon | 7 | 8<br>*Environmental field trips begin* |
| 9<br>*Environmental field trips begin* | 10 | 11 | 12 | 13<br>last quarter | 14 | 15 |
| 16 | 17 | 18 | 19 | 20 | 21<br>new moon | 22<br>ROSH HASHANA (Jewish New Year) |
| 23<br>30 | 24 | 25 | 26 | 27 | 28<br>Native Americans' Day<br>first quarter | 29 |

**Necklace and earrings.** *Urubu, Brazil. The Urubu tribe of Brazil make some of the finest featherwork in the world. These exquisite pieces typify the Urubu's delicate craftsmanship and exuberant use of color. Ca. 1970. Gift of Mr. and Mrs. Theodore W. VanZelst. Necklace length 36.5 cm; cat. 288246; 288240/a.b.*

# October 1979

## *Field Museum of Natural History*

| SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|
| | 1 YOM KIPPUR | 2 | 3 | 4 | 5 full moon | 6 *Ayer illustrated lecture 2:30 p.m.* |
| 7 *Discovery programs every Saturday and Sunday* | 8 Columbus Day | 9 *Draconid meteor shower (10/hr)* *Fall adult education courses begin* | 10 *Fall adult education courses begin* | 11 *Fall adult education courses begin* | 12 Columbus Day (traditional) last quarter | 13 *Ayer illustrated lecture 2:30 p.m.* |
| 14 | 15 | 16 | 17 | 18 | 19 | 20 *Orionid meteor shower (38/hr)* new moon *Ayer illustrated lecture 2:30 p.m.* |
| 21 | 22 | 23 | 24 United Nations Day | 25 | 26 | 27 *Ayer illustrated lecture 2:30 p.m.* |
| 28 first quarter | 29 | 30 | 31 Halloween | *Visit Pawnee Earth Lodge open daily* | | |

SEPTEMBER

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | | | | | 1 |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| 16 | 17 | 18 | 19 | 20 | 21 | 22 |
| 23 | 24 | 25 | 26 | 27 | 28 | 29 |
| 30 | | | | | | |

NOVEMBER

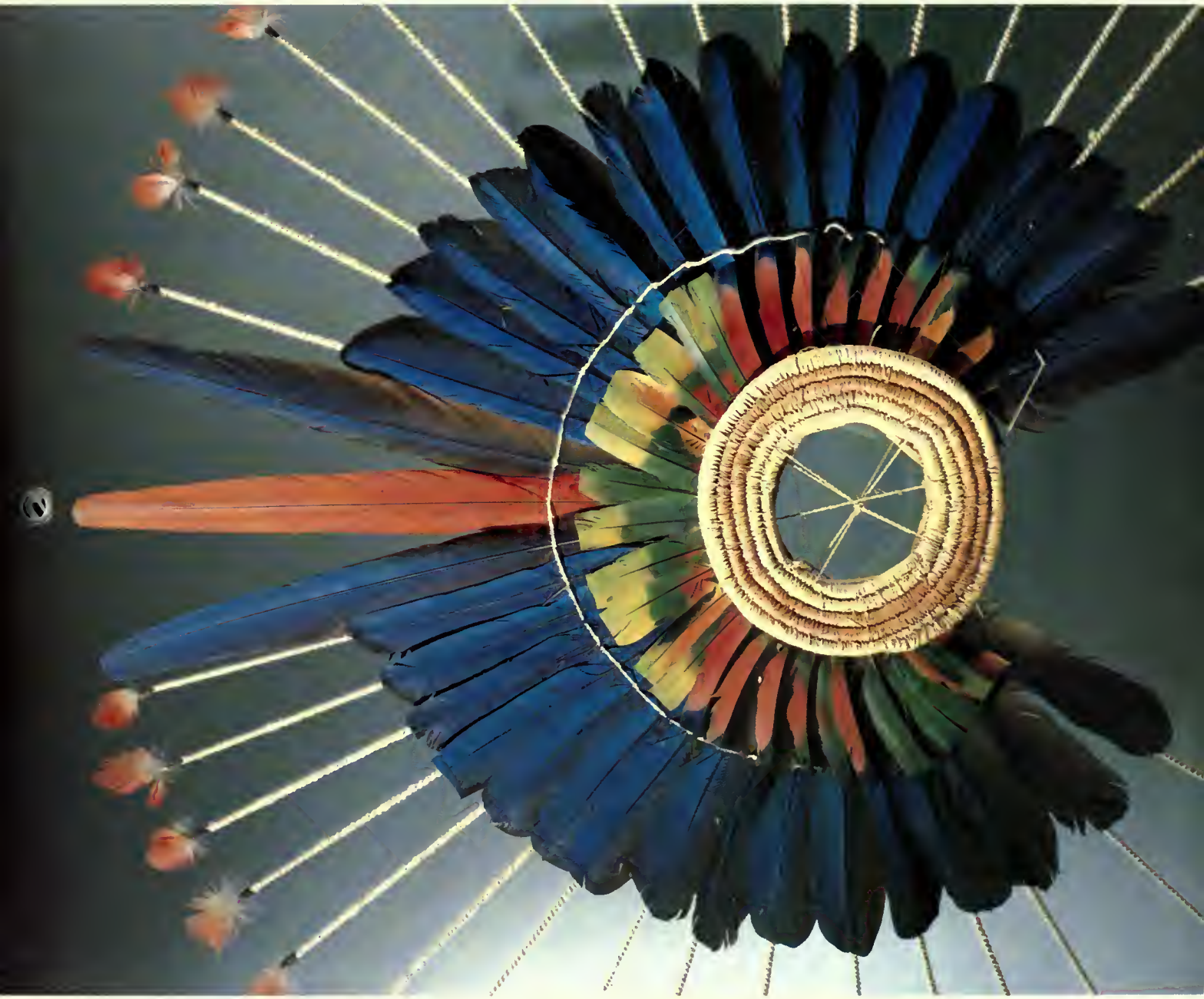
| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 |
| 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| 25 | 26 | 27 | 28 | 29 | 30 | |

**Man's headdress.** *Bila-an, Mindanao, Philippines. An elegant topknot of wild cock feathers is the focal point of this hat (salaon) worn for fancy dress occasions, both secular and religious. Early 20th century. Diameter 38 cm; height 33 cm. Cat. 129360.*

# November 1979

## *Field Museum of Natural History*

| SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|
| OCTOBER<br>S M T W T F S<br>1 2 3 4 5 6<br>7 8 9 10 11 12 13<br>14 15 16 17 18 19 20<br>21 22 23 24 25 26 27<br>28 29 30 31 | DECEMBER<br>S M T W T F S<br>1<br>2 3 4 5 6 7 8<br>9 10 11 12 13 14 15<br>16 17 18 19 20 21 22<br>23 24 25 26 27 28 29<br>30 31 | *Visit Pawnee Earth Lodge open daily* | | 1 | 2 | 3<br>*Discovery programs every Saturday and Sunday*<br>full moon<br>*Ayer illustrated lecture 2:30 p.m.* |
| 4 | 5 | 6<br>Election Day | 7 | 8<br>*Venus in conjunction with Mercury* | 9<br>*Taurid meteor shower (16/hr)* | 10<br>*Ayer illustrated lecture 2:30 p.m.* |
| 11<br>Veterans Day<br>last quarter | 12 | 13 | 14 | 15 | 16<br>*Leonid meteor shower (15/hr)* | 17<br>*Ayer illustrated lecture 2:30 p.m.* |
| 18 | 19<br>new moon | 20 | 21 | 22<br>THANKSGIVING | 23 | 24<br>*Ayer illustrated lecture 2:30 p.m.* |
| 25<br>*Andromedid meteor shower (10/hr)* | 26<br>first quarter | 27 | 28 | 29 | 30 | |



**Man's headdress.** *Karaja, Brazil. Made of macaw and parrot feathers. The wearer puts his hair through the opening and secures the headdress so it radiates halo-like about the head. Ca. 1970. Diam. 80.5 cm. Gift of Mr. and Mrs. Theodore W. VanZelst. Cat. 288205, 288206.*

# December 1979

## *Field Museum of Natural History*

| SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|
| NOVEMBER<br>S M T W T F S<br>1 2 3<br>4 5 6 7 8 9 10<br>11 12 13 14 15 16 17<br>18 19 20 21 22 23 24<br>25 26 27 28 29 30 | JANUARY<br>S M T W T F S<br>1 2 3 4 5<br>6 7 8 9 10 11 12<br>13 14 15 16 17 18 19<br>20 21 22 23 24 25 26<br>27 28 29 30 31 | | | *Visit Pawnee Earth Lodge open daily* | | 1<br>*"Image and Life: 50,000 Years of Japanese History" exhibit opens to public*<br>*Winter Journey: self-guiding tour* |
| 2 | 3<br>full moon | 4 | 5 | 6 | 7 | 8<br>*Discovery programs every Saturday and Sunday* |
| 9 | 10 | 11<br>last quarter | 12 | 13<br>*Geminid meteor shower (55/hr)*<br>*Jupiter in conjunction with Mars* | 14 | 15<br>HANUKKAH |
| 16 | 17 | 18 | 19<br>new moon | 20 | 21 | 22 |
| 23<br>30 | 24<br>31 | 25<br>CHRISTMAS<br>Museum Closed<br>first quarter | 26 | 27 | 28 | 29 |

# December & January at Field Museum

*December 15 through January 15*

## New Exhibits

**A Stamp Sampler: Postage from Natural History.** Opened December 8. This new exhibit unites 63 natural history specimens with samples of philatelic art. Planned on a rotating basis to cover the four disciplines of natural history, the first 8 months of the exhibit will be devoted to zoological specimens and their representations on stamps from all over the world. "A Stamp Sampler" was conceived by Field Museum volunteer Col. M. E. Rada, exhibit guest curator. The exhibition was designed by Peter Ho, a University of Illinois graduate student.

**Rails of the World.** Through Jan. 28, 1979. An exhibition of 42 watercolors, painted by J. Fenwick Lansdowne, represents the little-known bird family of Rallidae. The exhibition is part of a national tour organized by the Smithsonian Institution Traveling Exhibition Service. A combination of art, science, and artistic realism, the works were painted to illustrate the book *Rails of the World*, by S. Dillon Ripley, secretary of the Smithsonian. Hall 21.

## Continuing Exhibits

**Cash, Cannon, and Cowrie Shells:** The Nonmodern Moneys of the World. A fascinating collection that contains over 80 varieties of money used by ancient cultures. It explores the origins, values, and meaning of nonmodern money in terms of buying power for these past civilizations. The accompanying text gives the value of each form of money in terms of how much food it could then buy. Four general categories of moneys are on display: metal coinage, uncoined metal, shell money, and "miscellaneous," which includes food, fur, fiber, glass, teeth, and stone currencies. No closing date. Between Halls K and L, ground floor.

**Field Museum Gamelan.** Field Museum's 19th-century Javanese gamelan, an ensemble of 24 fine bronze and wood musical instruments, has been completely restored for exhibition. It is perhaps the finest gamelan outside Indonesia. Hall K, ground floor.

**The Hall of Chinese Jades** contains beautiful jade art spanning over 6,000 years of Chinese history. An exhibit in the center of the hall illustrates ancient jade carving techniques. Hall 30, second floor.

**American Indian Halls** trace the anthropological history and cultural development of the original Americans, from the time of their arrival on the North American continent (before 20,000 B.C.) to the present. Hall 5 contains a traditionally made Pawnee earth lodge—the home and ceremonial center of Pawnee Indians as it existed in the mid-1800s. Halls 4 through 10, main floor east.

**Tibetan Culture** can be explored in Hall 32, on the Museum's second floor. Rare film footage, shot in 1927, documents nomadic life and religious pageantry in Tibet. The Tibetan exhibits are divided into two sections. One hall displays common possessions from the past such as weapons, yak-herding equipment, and textiles. Lamaism, the Tibetan form of the Buddhist religion, is the theme of the second hall.

**The Place for Wonder.** This gallery provides a place to handle, sort, and compare artifacts and specimens. Weekdays, 1 p.m. to 3 p.m.; weekends, 10 a.m. to noon and 1 p.m. to 3 p.m. Ground floor, near central elevator.

## New Programs

**Among Wild Whales.** A film lecture by Dr. Roger Payne. January 10, 8 p.m. James Simpson Theatre. Payne is considered the first scientist to recognize the repeated pattern of "songs" emitted by humpback whales. His film includes rare sequences of feeding, social and mating habits, and migratory patterns of these endangered giants. Members $1.50; nonmembers $3.00.

**Winter Journey:** "American Indian Dwellings." Through February 28. This self-guided tour for families and children describes different types of American Indian homes found on the main floor of the Museum. Free *Journey* pamphlets are available at the North Information Booth, and at the South and West doors.

## Continuing Programs

**Friend or Foe? The Natural History Game.** Field Museum's popular "Anthropology Game" has been expanded to include botany, geology, and zoology. The object here is to determine which one of a pair of apparently similar specimens is harmful and which is not. See if you can distinguish a vampire bat, a head-hunter's axe, a poisonous mineral, or a deadly mushroom from its benign look-alike. Ground floor; no closing date.

**On Your Own at Field Museum.** Self-guided tour booklets, adult- and family-oriented, are available for 25¢ each at the entrance to the Museum Shop, main floor north.

**Weekend Discovery Programs.** Guided tours, demonstrations, and participatory activities. Every Saturday and Sunday, 10 a.m. to 3 p.m.

**Volunteer Opportunities.** Limited opportunities are available in botany, geology, and zoology. Weekend volunteers with an interest in natural history are needed to develop and present weekend programs. For more information call 922-9410, ext. 360.

**Adult Group Programs** provide an opportunity to attend special slide programs and tours of selected exhibits. Arrangements can be made to dine in one of the Museum's private dining rooms. Fall-Winter Programs include "Life in Ancient Egypt"; "The Weaver's Walk"; and "The American Plains Indian." For more information call (312) 922-0733.

**December and January Hours.** The Museum opens daily at 9 a.m. and closes at 4 p.m. Mondays through Thursdays. On weekends the Museum is open from 9 a.m. to 5 p.m. On Fridays the Museum remains open until 9 p.m. throughout the year.

**The Museum Library** is open weekdays 9 a.m. to 4 p.m. Obtain a pass at the reception desk, main floor.

**Holiday Closings:** The entire Museum will be closed on Christmas Day and on New Year's Day.

*Museum telephone: (312) 922-9410*